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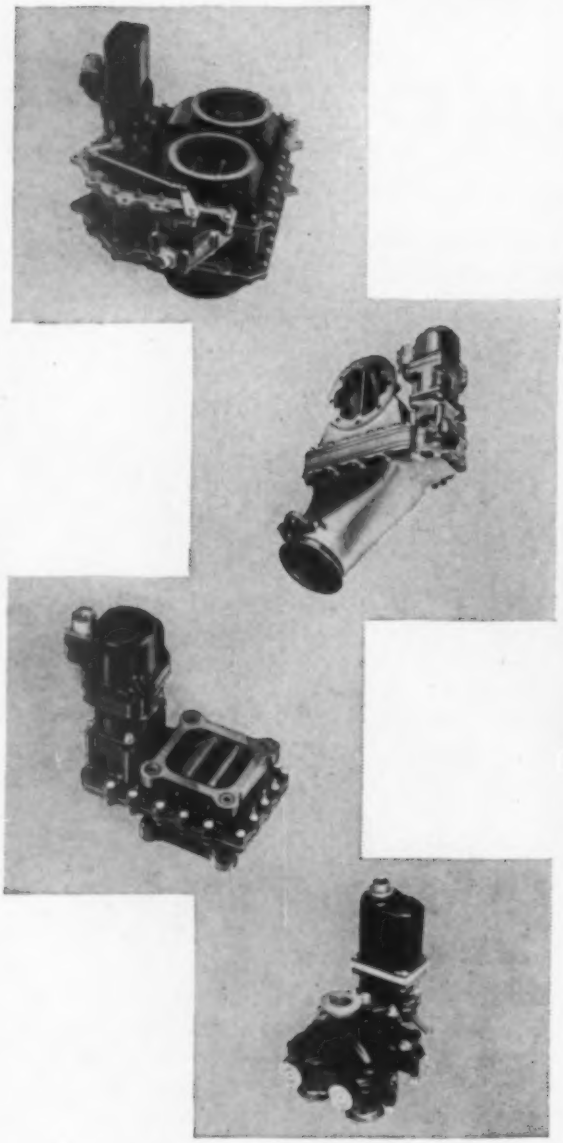

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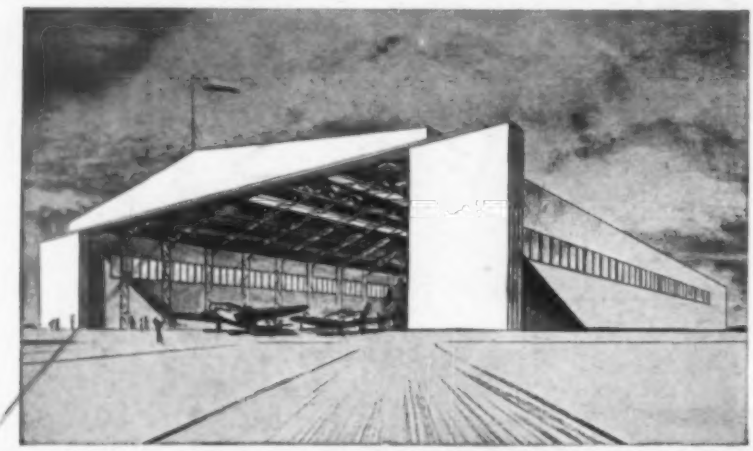

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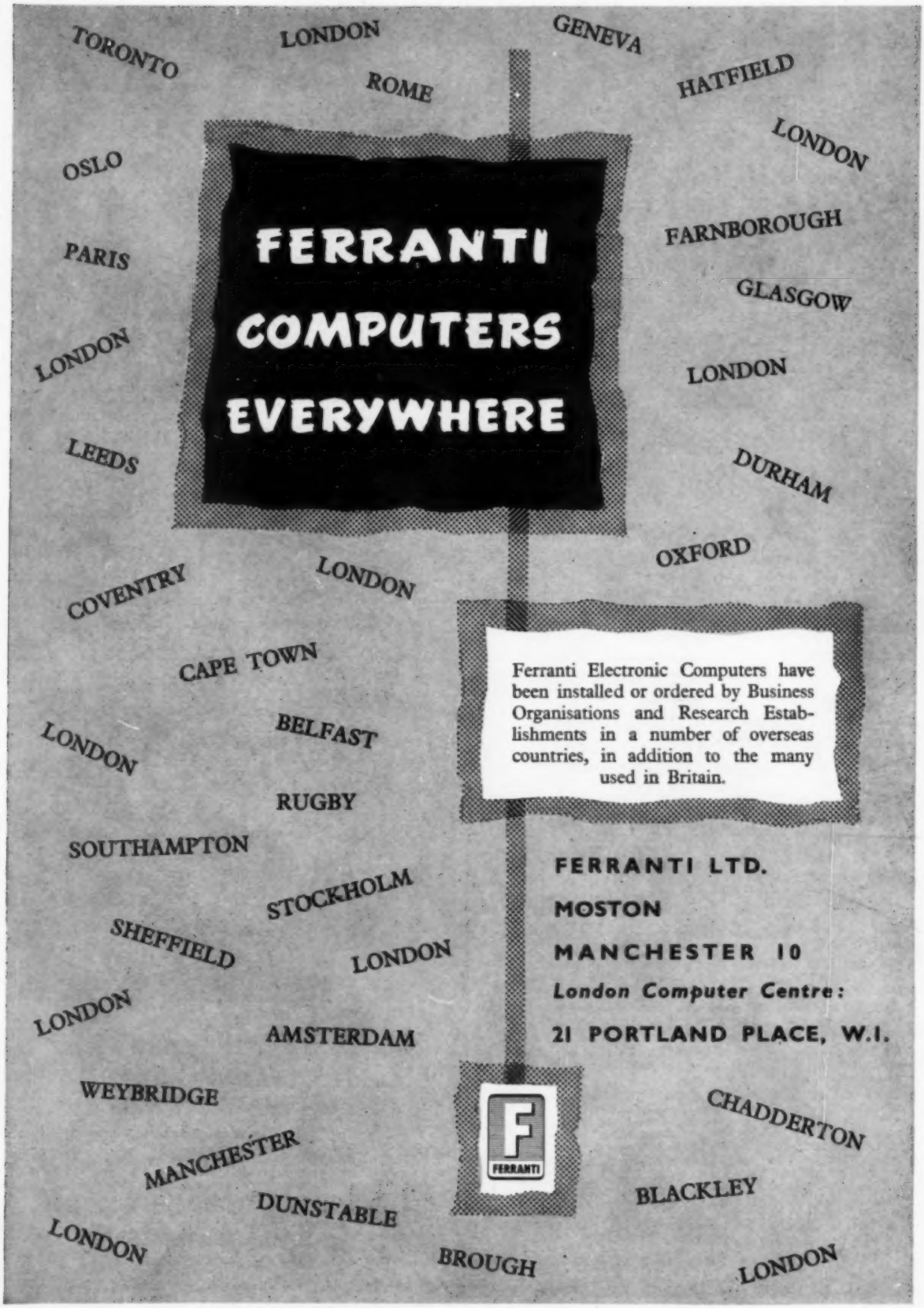
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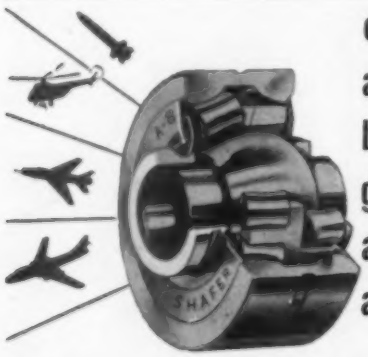

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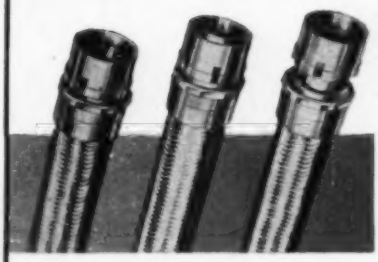

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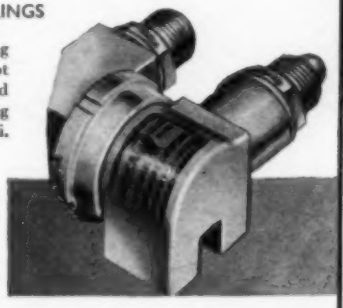

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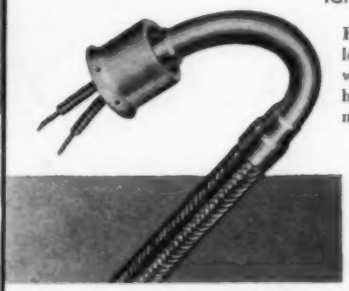

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FLIGHT
and
AIRCRAFT ENGINEER

No 2489 Vol 70 FRIDAY 5 OCTOBER 1956

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Freighter/Coach

THE instrument which the Hawker Siddeley Group will use to prise open the civil markets of the world is a pressurized, medium-range, "freighter/coach" aircraft, having military capability, built by Armstrong Whitworth, and powered with two or four Rolls-Royce turboprops. On the face of the Group's formal announcement (and a disappointingly bare face it is) this contender promises performance, economy, reliability and adaptability in unprecedented measure. Backed by immense technical and sales resources, it should yield a rich reward in a broad new field where others have as yet trodden timorously. Not only in terms of capital outlay and technical approach is this newest British venture a bold one; it is worthy of remark, for instance, that although "The Group" has itself nurtured an outstandingly fine turboprop—the Armstrong Siddeley Mamba—it has nevertheless recognized the unique and ever-widening acceptance of the Rolls-Royce Dart, and the concomitant sales value of a powerplant with an established commercial reputation.

The military implications of the Hawker Siddeley announcement are of real and immediate significance, for the specified characteristics appear to be those demanded of a Valetta replacement. The "direct loading" feature, in particular, suggests that the new machine will meet the heavy-dropping requirement so often propounded by the Army but never yet realized in a medium-transport aircraft of British origin.

—or the New Argosy

This military consideration is a reminder of the enviable, if now largely forgotten, record of "A.W.A." as constructors of transport aircraft. As long ago as 1923 they built for the R.A.F. a great load-carrying biplane which they called (with an admirable sense of publicity) the Awana. Three years later they followed with the triple-engined Argosy, so warmly remembered by a diminishing few for its years of service on the London-Paris run. Then came that very remarkable four-engined cantilever monoplane the Atalanta, with its fixed undercarriage of unsurpassed cleanness; and soon, following it into the service of Imperial Airways, the massive Ensign, boasting the largest retractable landing gear of its time. The early post-war years saw the Mamba-powered Apollo emerge as a worthy, if unsuccessful, rival of the Viscount; but though various civil projects have since been under study at Baginton—"flying wings" and a five-Sapphire jet-liner among them—practical work was, until recent days, suspended.

Certainly the youngsters of the industry and the many prospective buyers of the new transport will do well to remember that its designers and makers are no mere sub-contractors of Sea Hawks, Hunters and Javelins. These people know the transport and bomber business from thirty-odd years back; and should they need a reference in respect of workmanship, any Sea Hawk pilot or rigger will be found eager to provide one.

It is important (in our own estimation at least) that the new freighter/coach should be launched on the turbulent tide of commerce so titled as to proclaim its inheritance and its purpose; and if this be so, then surely it must perpetuate the name of Argosy. We are unaware of any aeroplane now building which holds more promise of our seeing

". . . the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight dropping down with costly bales."

Insofar as A.W.A. and R-R. are concerned, of course, those bales will be far from costly, and the magic of the "sails" will be of a very substantial kind indeed. But we can hardly doubt that the Tennysonian argosy will prove (in the terms of the Hawker Siddeley handout) to "achieve an economic balance between volumetric capacity and maximum payload in either the passenger or freighter rôle, and offer most competitive operating costs based on the average factors now being achieved by operators."

ETENDARD IV: Tactical support is the primary mission of the Marcel Dassault Etendard IV, lately demonstrated before representatives of NATO and the French air forces. Powered with a S.N.E.C.M.A. Atar of 7,700 lb thrust and armed with two DEFA 30 mm guns, it weighs between 12,100 lb and 14,300 lb, according to mission. Although "slightly supersonic" in level flight, it can unstick and land in 550 yards.

FROM ALL QUARTERS

The Vulcan Accident

THE Avro Vulcan which was completing a 26,000 mile round trip to Australia and New Zealand was destroyed last Monday on landing at London Airport. The aircraft commander, S/L. D. R. Howard, and Air Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command, who was flying as co-pilot, successfully used their ejector seats. Four other crew members lost their lives. They were S/L. J. G. W. Stroud, another pilot, S/L. E. J. Eames, navigator, S/L. A. E. Gamble, Air Electronics Officer, and Mr. F. Bassett, an Avro service representative.

The Vulcan was due to land at 1108 hr. Weather was poor, with visibility of 1,500 to 2,000 yd in mist and rain. Civil airline flights were operating at a reduced rate, using runway No. 1 (100 deg). The G.C.A. caravans were in position beside runway 10 Left.

First sign of the Vulcan's arrival was the sound of a brief burst of full power out in the mist at the touchdown end of 10 Left. *Flight's* representative, standing on the roof of the Queen's building in the airport central area, then saw the Vulcan climbing very steeply up from the runway with undercarriage down. At an angle of about 40 deg it climbed quietly to about 800ft when the cabin roof blew off and both pilots ejected in quick succession. The automatic devices of the Martin-Baker Mk 3 seats functioned immediately and both men were in stable descent before losing any height. The Vulcan then turned gently to starboard and dived at an angle of 20 to 30 deg onto the starboard edge of runway No. 4 where it exploded on impact, leaving a 300 yd swath of wreckage which burnt for nearly an hour.

Sir Harry Broadhurst landed on runway 10 Left and injured both his feet; S/L. Howard touched down on grass and had a bruised forehead and slightly hurt back.

A Hawker Siddeley Group statement issued later in the day said that S/L. Howard was making a normal G.C.A. approach and that nothing appeared to be wrong with the aircraft. Some 600 yd short of the runway the aircraft touched down in a field and lost 15 of its 16 main wheels and parts of the undercarriage legs. Power was immediately applied, but seconds later it was clear that the machine was out of control and the order was given to abandon ship. Only the two pilots have ejector seats; the rest of the crew have to escape through a hatch in the cabin floor, and none of them succeeded in doing this in the seconds available. An R.A.F. court of inquiry was opened on Tuesday headed by Air Chief Marshal Sir Donald Hardman, Air Member for Supply and Organization.

When the accident occurred the Vulcan was concluding a most successful visit to Australia and New Zealand where its outstanding performance and impressive appearance had created great interest, official and unofficial. It had made the flight from Australia in four stages, landing at Singapore, Negombo and Aden. Though seeking no records it had averaged well over 500 m.p.h. on many of its flights overseas.

Lord Hives to Retire

IT is announced by Rolls-Royce, Ltd., that Lord Hives, C.H., M.B.E., has decided to retire from the board of the company next January. He was first appointed to the board of Rolls-Royce in 1936 and has been chairman since 1950. Few men in the aircraft industry have commanded the respect enjoyed by Lord Hives. He was a mechanic in 1908 and has since risen from the bottom to the top of the company whose name is a by-word in engineering excellence. He was 70 in April of this year, and we shall publish an appraisal of his work when his retirement takes effect.

He will be succeeded as chairman by Lord Kindersley, C.B.E., M.C., whose distinguished war record is matched by his ability in the board room. He was appointed to the board of Rolls-Royce, Ltd., five years ago and became deputy chairman in 1952; he is also *inter alia* a member of the Court of the Bank of England, governor of the Court of the Royal Exchange Assurance, managing director of Lazard Brothers and chairman of the British Match Corporation. Mr. J. D. Pearson, J.P., and Mr. Whitney Straight, C.B.E., M.C., are appointed deputy chairmen; the former will succeed Lord Hives as chief executive of the company and will continue as managing director of the aero engine division. Mr. F. Ll. Smith continues as managing director of the car division and Mr. W. A. Robotham is appointed managing director of the oil engine division.

Back to the Frozen North

BLACKBURN Beverley XB262 took off last week from the makers' airfield at Brough, Yorks, to continue winterization trials at Namao in northern Canada. Beverley XB262 is the aircraft which underwent tropical trials in North Africa this summer and now bears the legend "Try Your Strength—Blackburn Beverley" in Arabic over the pilot's door, and the polar bear badge of the Climatic Detachment on the nose. On board were 17 people and approximately 12,000 lb of spares and equipment, including a Centaurus engine and a de Havilland airscrew.

Captain of the aircraft is S/L. R. H. Janzen, R.C.A.F., who will fly it during the trials. Co-pilot on the ferry flight was G/C. S. L. Ring, Superintendent of Flying at Boscombe Down; other crew members were R.C.A.F. officers. In addition to air force ground crew, there were on board Mr. C. Harrop, Bristol service engineer, Mr. H. Hall, de Havilland service engineer, and Messrs. R. W. Hilken, J. Langley and J. E. Millward of Blackburns. The outbound flight was made *via* Prestwick, Keflavik, Goose Bay, Ottawa and Winnipeg. The 1,520 miles leg between Keflavik and Goose Bay was covered in exactly 8 hours.

William E. Boeing

FOUNDER of what is now one of the largest aircraft companies in the world, Mr. William E. Boeing died suddenly aboard his yacht last Friday, September 28. He had been in failing health for some years.

Born in Detroit in 1881, he studied at the Sheffield Scientific School, Yale, from 1899 to 1902. He was one of the first American private pilots, having been taught to fly by Glenn L. Martin, and in 1916 founded the Pacific Aero Products Company. Unlike many of its contemporaries, the firm prospered during the 1920s and expanded rapidly, taking the name of The Boeing Airplane Company in 1929. Five years later Mr. Boeing severed his financial connections with the firm and in the same year was awarded the Daniel Guggenheim medal for "successful pioneering and achievement in aircraft manufacturing and air transport."

Recent Boeing products scarcely require description; but the company's earlier prowess is less well known. More than 30 years ago research was progressing upon electrically welded steel airframes and Boeing were one of the first firms to produce such items as successful oleo struts for undercarriage and arresting equipment; underslung, inclined-core radiators; reel-type feed for fixed guns to prevent belt-kinking during manœuvres; and a combined trigger and throttle control for high-speed fighters. Another

"first" was the Model 247 of 1933 which was the pioneer all-metal, low-wing, twin-engined, cantilever monoplane with retractable undercarriage to go into production for airlines.

Boeing himself flew his firm's aircraft extensively and in 1920 carried the first sack of mail into the United States from Canada, using the B-1 flying-boat, which subsequently flew over 350,000 miles on trips between Seattle (always the company's headquarters) and Victoria, B.C., wearing out seven engines in the process. In 1927 the U.S. Government turned over the established mail routes to private contractors and Boeing Air Transport, Inc., was organized to operate the important one between San Francisco and Chicago. This line of 1,950 miles was then the longest and perhaps most difficult regularly served air route in the world, and the famous Boeing mail planes operated it with renowned success. Later the Boeing interests acquired the Pacific coast route from Seattle to Los Angeles, forming the nucleus of the network which became United Airlines in 1928.

Retirement of Mr. F. T. Hearle

THE retirement was announced, last weekend, of Mr. F. T. Hearle, C.B.E., F.R.Ae.S., M.I.P.E., from the Board of de Havilland Holdings, Ltd., parent company of the organization.

Frank Hearle has been associated with Geoffrey (now Sir Geoffrey) de Havilland from the very earliest days of the latter's aeronautical ventures. Born in Cornwall 70 years ago, he was apprenticed to marine engineering, but soon transferred to the Vanguard motor-bus works at Walthamstow, London, and it was there that he met the young de Havilland. Soon they entered into an aeroplane-building partnership that culminated in the successful flight of 1910. Two years later they drifted apart, Hearle working for Deperdussin and then for Vickers; but in 1917 they were together again, with "D.H." as chief designer at the Airco works in Hendon and Hearle in charge of the experimental shop. In 1920 the de Havilland Aircraft Co., Ltd., was formed, and Hearle was one of its founder-members; in 1922 he was made a director.

Mr. Hearle.

In the inter-war years he was concerned with the production of such famous types as the Moth and Dragon and their successors; in 1927 he planned an engine factory and had it in production within 16 weeks; in 1930 he laid out the Hatfield works; and in 1935 he went to America to negotiate the British Empire manufacturing rights for Hamilton controllable-pitch airscrews.

In the Second World War, as managing director, he carried the main responsibility for production of de Havilland aircraft, engines and airscrews on an ever-increasing scale. It was then that his health made it necessary for him to hand over his daily executive duties to his colleague Mr. W. E. Nixon, though he remained a director of the parent company and several of its subsidiaries. From 1950—in which year he was appointed C.B.E.—to 1954 he served as chairman of the Aircraft Company. On January 1 this year, with the reorganization of the group into a holding company and three main operating subsidiaries, Mr. Hearle ceased to be a director of the de Havilland Aircraft Co., Ltd., but was appointed to the Board of de Havilland Holdings, Ltd., from which he now retires.

Exports Up Yet Again

IN the first eight months of 1956 British aircraft exports totalled a greater value than for any complete year in the past. The August figure of £7,744,214, recently announced, brought the 1956 sum, so far, to £73,057,779; this was some £7m more than last year's record figure, and is proportional to an annual rate of £110m.

Complete aircraft accounted for £51½m, engines for £18½m, and electrical equipment, tyres and instruments £3m.

During August, complete aircraft worth £1,453,987 went to America. Our next best customer was Australia (£369,614), followed by Belgium (£345,000) and Rhodesia (£337,573). Thirty major countries received British aircraft, yet no fewer than £1½m worth of such products are listed as having gone to "other foreign countries."

***DUFF GEN:** Complaining that the map he carried showed a prepared strip, which he did not, in fact, find, the pilot of this Polish Mig-15bis, which put down recently on the Danish island of Bornholm, sought political asylum. The strip is presumably now being torn off a Polish intelligence officer.*

It is significant, remarks the S.B.A.C., that the aircraft, engines and components that go to make up the imposing total were ordered up to a year or more ago, and the number of contracts signed in 1956 gives some indication of the industry's export effort in the next year or two; by this yardstick it is an encouraging picture.

Second X-2 Lost

THE second Bell X-2, which had flown higher and faster than any other aircraft in the world, crashed near Edwards Air Force Base, California, on September 27. Its pilot, Captain Milburn G. Apt, who was making his first flight in the machine, was killed. The X-2 had been launched from a B-50 at about 30,000ft.

The first X-2 was lost in May, 1953. In this second one Lt-Col. F. Everest had flown at 1,900 m.p.h. and Capt. Iven Kincheloe had climbed to 126,000ft.

Mr. Leston Faneuf, president of the Bell Aircraft Corporation, said after the crash that he doubted whether another X-2 would be built, because "nearly everything that had been intended had been accomplished before the crash."

A. V. Roe Canada Shares

FIVE HUNDRED THOUSAND common shares in A. V. Roe Canada, Ltd., of Toronto, are being offered for sale at $16 per share to private Canadian investors during this month. Previously the company had been wholly owned by the Hawker Siddeley Group, who are retaining more than 80 per cent of the capital. It has now been disclosed that the profits of the Canadian group of A. V. Roe companies, after payment of tax and depreciation, rose from $3m in 1952 to a peak of $9m in 1955, and were $8.9m for the year ended July 1956. The Canadian operating firms now comprise Avro Aircraft, Orenda Engines, Canadian Steel Improvement, Canadian Car and Foundry, and Canadian Steel Foundries (1956), Ltd., with A. V. Roe Canada as parent company, and Racair, Ltd. (newly formed), as Canadian holding company for the Hawker Siddeley Group.

Official Convair 880 Figures

THE first official data for Convair's new medium-haul jet airliner have just been issued by the manufacturers. We included in our Airliners of the World issue on July 6 as many data as could be gathered about the Golden Arrow (as it was then known: it is now the Convair 880). The new figures, with one exception, tally closely; the exception is gross weight, which is now 173,500 lb and not 178,500 lb. The new figures, which may be compared with those in our July 6 issue, are as follows:—

Convair 880. Level flight maximum cruising speed, 609 m.p.h. at 25,000ft at 130,000 lb gross weight; payload (standard 80 passenger version), 21,700 lb, and (108 passenger tourist version), 26,320 lb; maximum take off weight, 173,500 lb; maximum permissible landing weight, 130,000 lb; empty gross weight (basic operational), 80,800 lb; maximum range at gross weight with full 80-passenger payload, 3,000 miles; gross weight take-off and max. landing lengths, 8,300ft and 5,400ft respectively; take-off and landing distances at 128,000 lb take-off weight (giving range of 500 miles with full 80 passenger payload), 4,150ft and 5,400ft (landing weight 117,000 lb) respectively; wing span, 118ft 4in; length, 124ft 2in; height 37ft 4in; cabin pressure differential, 8.2 lb/sq in.

TF-102A Handling Report

OUR American contemporary, *Aviation Week*, has begun a series of aircraft handling reports similar to *Flight*'s "In the Air" articles. The latest account published describes a flight in the Convair TF-102A made by a full-time member of *Aviation Week's* staff, Mr. Richard Sweeney. He reports that the aircraft is pleasant to fly, has autostabilization in all three axes selected by the pilot and passes smoothly through Mach 1 now that two rows of vortex generators have been attached over the canopy. He reached Mach 1.2, but infers that the TF-102A is not sonic on the level. Full armament allows the TF-102A to double as trainer and operational intercepter. Indicated touch-down speed is 125-130 kt.

CONVERTIPLANE TECHNIQUE

The Fairey Company's work with the Jet Gyrodyne

CONSIDERABLE development work on various types of so-called convertible aircraft has been done both in Europe and America. A variety of configurations of convertiplane are now under test and a rather greater variety of claims have been made for them.

The Fairey Aviation Company has for some time been working on the unloaded-rotor convertiplane principle (also followed by McDonnell in America) and in the not-too-distant future the prototype of the Rotodyne is to make its first test runs. The general principles of this type of convertiplane are well-known. Helicopter flight is achieved by using a tip-driven rotor controlled in cyclic and collective pitch in normal helicopter fashion. For transition to fixed-wing cruising flight the compressors which supply air for the rotor-tip drive are progressively disengaged and engine power transferred to normal horizontal thrust airscrews. The transfer of power leaves the rotor as a freely revolving unit, the lift from which is supplemented by the lift of a fairly conventional fixed wing. Manœuvring in the fixed-wing flight condition is achieved through the normal helicopter rotor controls, and stability is assisted by fixed surfaces at the tail.

Important original work by the Fairey company has resulted in the development of a successful and simple control technique for the transition from helicopter to aeroplane flight and *vice versa*. With the Jet Gyrodyne, Faireys were first in the world to secure a complete and realistic transition cycle in flight, the feat having been achieved on March 1 last year by John Dennis as pilot. By the following June the technique was well established and transitions need not now be accompanied by loss of height. Complete transition was fully demonstrated at the S.B.A.C. Show last year, during preparations for which no fewer than 65 successful tip-jet relights were accomplished in flight in the space of eight days. To date 190 transitions and 140 autorotative landings have been made. The technique is now familiar and understood, and the basis of the operating procedure for the Rotodyne has thus been established well in advance.

It was the second of the two original Fairey Gyrodyne helicopters, made in 1947 and 1948, which was converted in 1953 into the Jet Gyrodyne. For this purpose a specially modified Alvis Leonides was mounted with its crankshaft fore-and-aft in the fuselage, directly driving a gearbox from which two shafts led out along the stub wings to drive two variable-pitch pusher propellers of Faireys' own design.

Small in comparison with the rotor disc area, the stub wings contribute very little lift. The pitch of the propellers is collectively and differentially controllable. A third drive is taken from the central gearbox to a friction-plate clutch and thence to two Merlin compressors mounted face to face under the rotor pylon. The rotor itself has no form of mechanical drive, air from the compressors being fed to thrust units at the rotor blade tips. The pitch of the blades is controlled in normal helicopter fashion by collective- and cyclic-pitch levers. Rudder pedals provide directional control by differential adjustment of the pitch of the two propellers. Duplicated Fairey Hydrobooster hydraulic, fully-powered servo units relieve this control of excessive forces.

"Flight" photograph

The Fairey Jet Gyrodyne, here seen in flight, was the first machine ever to achieve complete transition from helicopter to autogyro flight and vice versa. This procedure has now been fully explored.

The Jet Gyrodyne is, of course, purely a test-bed and was constructed mainly to prove the convertiplane layout. With an average loaded weight of 6,600 lb, it is a little short of power, and normally operates at full bore. In the Rotodyne there will be ample power to spare, and the transition will be a great deal easier.

One of the Jet Gyrodyne's most important features has been the successful development of the tip burners, the design of which has defeated several other experimenters in this field. Faireys are now getting quite reasonable life and efficiency from their burner components. As described above, the tip jets are supplied with compressed air passed through the blades from the Merlin compressors. Centrifugal force provides pumping energy for fuel which is metered by a regulator in the fuselage; this regulator is controlled by pressure capsules which sense the delivery-air pressure in the rotor-head distributor. Such pressure is most easily gauged at the rotor head, and the instrument indicating it figures importantly in the transition process.

The best way to describe the functioning of the Jet Gyrodyne's lifting and translational flight systems is to run through the operating technique which has been developed for it, and which will be applied in principle to the Rotodyne. The process is to a limited extent automatic, the automaticity having been established by early flight-test experience; but it is naturally envisaged that in the Rotodyne the procedure will include a greater degree of automatic control.

The cockpit of the Jet Gyrodyne differs little from that of an ordinary helicopter, but there are two major additions to normal helicopter controls, namely, a thumb-switch attached to the collective-pitch lever, and a lever moving over a series of gated positions on a small console close to the pilot's left hand.

The switch controls the collective pitch of the propellers. The gated lever has several positions. On the ground it is normally in the "rotor brake on" position, but immediately before starting it is moved forward into the "brake off" position, when a spring-loaded safety-catch flips over to prevent inadvertent application of the rotor brake. The lever is next moved across to engage the friction-plate clutch which connects the Merlin compressor to the Leonides transmission. It is then moved further to the left and pulled back into another gated position which turns on the fuel supply to the tip jets and switches on the ignition system, which is permanently in operation whenever the tip jets are in use. The twist-grip throttle on the collective-pitch lever controls only the Leonides throttle setting and is not connected in any way to the rotor collective-pitch controls. Finally there is a hand-grip on the cyclic-pitch lever which, when squeezed,

Much useful work has been done with the Jet Gyrodyne since 1953 when it was rebuilt from the second prototype of the Gyrodyne helicopter.

Seen tail-on, the Jet Gyrodyne shows its rudderless fins, tailplane trim tab, two variable-pitch pusher propellers and 60ft diameter, two-bladed rotor with tip-jet drive. The tail cone can be removed to expose the Alvis Leonides engine.

"Flight" photograph

centres a spring-feel mechanism that tends to maintain the stick in its position at the moment of squeezing. This provides effective cyclic-pitch trimming.

On starting, the gate lever is set to "rotor brake off" and airscrew pitch adjusted to 0 deg. The compressors being thus disconnected, the Leonides is started in the normal way and drives the propellers at zero pitch. The rotor remains stationary. After warming-up, the gated lever is moved across to clutch-in the Merlin compressors and compressed air begins to flow to the tip jets, turning the rotor under air drive alone.

All engine power is thus devoted to supplying compressed air to the tip jets, which must now be lit so that the machine can take off as a helicopter. The engine is opened up to full power and compressed air alone speeds the rotor up to about 120 r.p.m. with a head pressure of 20 lb/sq in. The gated lever is then moved further across and back, to start fuel flowing and to initiate the ignition system. At this point the mixture is too weak (and the mass flow too high) to allow lighting, and a spray of fuel emerges from the tip jets. By throttling back momentarily, however, the mixture strength is automatically adjusted to a condition for lighting up, and full tip burning is established. A normal helicopter take-off is then made.

As the cyclic-pitch stick is moved forward and speed is gained, collective propeller pitch is progressively increased to reduce drag. From 5 to 7 deg positive pitch is required at 50-60 kt, but this has little effect on the compressor delivery. Although transition from helicopter translational flight to Gyrodyne flight can be made over a wide range of forward speeds, it has been found most convenient to do so at 70 kt, with a rotor speed of 205 to 210 r.p.m.

The basis of the transition sequence is the transference of engine power, from the compressors supplying the tip jets, to the propellers. For this purpose the propeller collective-pitch-change motors controlled by the thumb-switch are mechanically linked to "umbrella" valves at the compressor intakes. As pitch is coarsened to obtain thrust, the umbrella valves close to unload the compressors and most of the engine's power is absorbed by the propellers.

The transition is carried out as follows. The pitch of both propellers is progressively coarsened by use of the thumb-switch, thus automatically reducing the air delivery from the compressors. At 6 lb head pressure the tip jets flame-out of their own accord and the rotor continues as an autogyro unit. Rotor collective pitch is set at about +1 deg and propeller pitch at the maximum collective setting of +19 deg. The gated lever can then be moved across and back to declutch the Merlin compressors; engine speed increases by about 200 r.p.m. and all the power is delivered to the propellers.

In this autogyro flight condition all the Jet Gyrodyne's lift is provided by the rotor and all its thrust by the propellers. Lateral and longitudinal control is exercised by rotor cyclic-pitch adjustment, and fore-and-aft fuselage attitude can be regulated by mechanically actuating a large trim-tab on the tailplane. Faireys designed the tail surfaces in relation to rotor diameter so that no difficulties are experienced through downwash effect on the tail.

Directional control is achieved through the rudder-pedal circuit, which governs the differential pitch of the two propellers over a range of ±5 deg. This differential-pitch range is superimposed on the collective-pitch so that, while collective pitch can be adjusted between −1 deg and +19 deg, the total available pitch range for each propeller is from about −5 deg to +24 deg.

In the early days, the transition from helicopter to Gyrodyne flight described above was relatively easy. The difficult part, from the pilots' point of view, was the transition back to helicopter flight. A good deal of flying and experiment were required before the tip-jet relighting sequence had been worked out so that the full transition could be achieved, thus ensuring a helicopter landing (as distinct from a landing in autorotation) at the end of each flight. It should be remembered that much of the difficulty was caused by the fact that there was no reserve of power available to prevent the Jet Gyrodyne from losing height during the relighting phase when the airscrews had been fined-off. The machine descended in autorotation until the jets were relit.

The drill, as finally established, is as follows. The compressor clutch is engaged—the engine being momentarily throttled back to about 1,300 r.p.m. in order to spare the clutch linings—and the gated lever is moved across and back to switch on tip-jet ignition and fuel supply. Head pressure is then about 1 lb/sq in, and propeller pitch is progressively fined-off so that the compressor "umbrella" valves start to open. When the head pressure reaches 6 lb/sq in, the tip jets relight, and rotor collective pitch is increased to hold down rotor speed. Propeller pitch is finally brought back to zero to obtain full tip-jet thrust. The pitch must be reduced slowly in order to prevent tip-jet air-pressure surge, which would blow the flame out. The Jet Gyrodyne can now be landed as a helicopter with the propellers rotating at zero drag. It is possible, however, to land with the propellers at some positive pitch, the main effect being to tilt the fuselage into a tail-down attitude. Excessive pitch may cause the fins to touch the ground.

The Jet Gyrodyne's two-blade rotor is very large—its diameter is 60ft—and has a high inertia. It can operate efficiently over an exceptionally wide rotational speed range—240 r.p.m. to 155 r.p.m. In fact, in autogyro flight at 80 to 85 kt, 175 r.p.m. is quite comfortable. An autorotative landing is correspondingly easy and, after descending at the best gliding speed of 40 kt, it is perfectly easy to hover for a while before touching down. In the engine-out condition the propellers stop and directional control is maintained through the fins and by rotor cyclic-pitch adjustment. This high rotor inertia and wide operating r.p.m. range is also a feature of the Fairey Ultra-Light: a particularly impressive demonstration was given at the S.B.A.C. display by S/L. Gellatly, who descended precipitately in autorotation from about 1,000ft and pulled up a few feet from the ground, to hover for a while before touching down.

The Jet Gyrodyne carries only 50 gallons of fuel. Its safe endurance with the tip jets alight is therefore in the region of only 15 minutes or so. Extra tanks have been carried under the wings to raise this endurance to something in the region of half an hour. The machine is at present being flown by the Fairey test pilots, S/L. W. R. Gellatly and Lt-Cdr. J. G. P. Morton, and a further, probably final programme of about 60 hours is to be completed for the M.o.S. But the Jet Gyrodyne has done its work and the main effort is now concentrated on the Rotodyne—for which, incidentally, a very large, full-scale static-test rig is being prepared at Boscombe Down.

AIR-REFUELLING A HELICOPTER

THE manufacturers of the Vertol H-21C have lately released information as to the method adopted for air-refuelling one of these twin-rotor helicopters during its recent transcontinental flight in America. The machine was airborne for 31 hr 40 min, during which time it flew 2,610 miles.

As shown in a photograph published in *Flight* of August 31, the tanker was a de Havilland Otter (U.S. Army designation—U-1a), and during the flight it transferred 1,200 U.S. gallons of fuel to the H-21C in four operations. On two other occasions the helicopter refuelled by hovering above a ground tanker.

The flight refuelling procedure was that the Otter and the H-21C flew in line ahead at about 75 kt. The helicopter then moved slightly to port and lowered a four-pronged grappling hook attached to the standard hoist. At the same time the Otter trailed a 200-ft hose supported by a small parachute. The helicopter pilot then flew his machine in an arc from left to right so that the grappling hook fouled the hose; the hose was then drawn into the helicopter through the rescue door and refuelling began. By this method, with the tanker flying to one side of the helicopter and at an only slightly higher altitude, there was very little risk of the hose touching the rotor blades.

Vertol—who recently received an order from the French Government for 100 H-21Cs—state that the flight was arranged to prove the practicability of ferrying helicopters as much as 3,000 miles to increase the striking power and mobility of ground forces.

Stronghold Linton-on-Ouse

A SEQUEL to Gordon Horner's "Stronghold Waterbeach" last week, this set of sketches depicts activity—and inactivity—at Linton-on-Ouse. Above is conveyed the bustling but orderly re-arming of a Hunter. Horner's caption to the scene on the left is: "O.K. Blue Section. You're on the O.R.P. at 10," and immediately below he treads quietly in the presence of F/O. P. A. Robert, B Flight, 92 Squadron. Scrambling at lower left is the black-finned Meteor of W/C. J. C. Forbes, D.F.M., officer commanding, 264 Squadron; and the tailpiece shows Hunter fins, shark-like over the morning mist.

SIR RICHARD FAIREY

A Great Designer and Industrialist

WITH deep regret we record the death, in the early morning of September 30, of Sir Richard Fairey, M.B.E., Hon.F.R.Ae.S., Hon.F.I.Ae.S., founder and executive chairman of The Fairey Aviation Co., Ltd. Sir Richard, who was 69, had been suffering for several years from an ailment of the heart and chest. For some days he had been under observation and treatment in a London nursing home, and he had undergone an operation on September 29. This was successfully completed but several hours later Sir Richard suffered a respiratory failure.

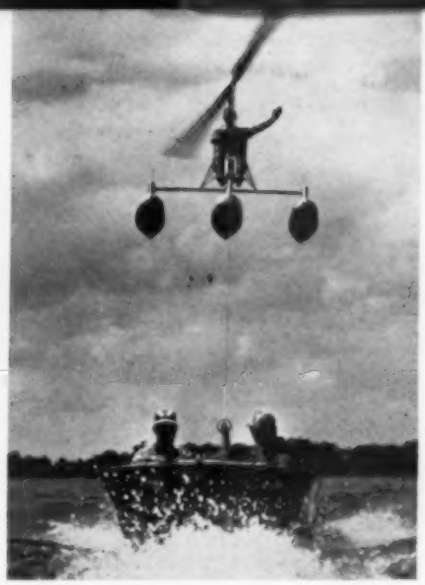
Charles Richard Fairey was born on May 5, 1887, at Hendon, and was educated at the Merchant Taylors' School and at the Finsbury Technical College (City and Guilds), where he qualified as an electrical engineer. In that profession he rose quickly, but even in those early days he was taking a keen interest in aviation, devoting all his spare time and energy to the making of models. By 1910 these had achieved records for height, speed and distance. In 1911 he relinquished his electrical career and obtained a post with the Blair Atholl Syndicate, then working on tailless aircraft to the designs of J. W. Dunne at Eastchurch, Isle of Sheppey. While thus employed Mr. Fairey met Vincent Nicholl, Maurice Wright and F. G. T. Dawson, all of whom were later to assist him in building up his great organization. In 1913 he joined Short Brothers as chief engineer, and two years later founded his own company, with a factory at Hayes, Middlesex, and a drawing office in Piccadilly. Having constructed Short seaplanes and Sopwith 1½-Strutters, the company embarked on the manufacture of its own designs, as later recounted.

From 1922 to 1924 Mr. Fairey was chairman of the Society of British Aircraft Constructors, and from 1923 to 1926 a member of the Aeronautical Research Committee. He was President of the Royal Aeronautical Society for 1930/31 and 1932/33, and was awarded the Wakefield Gold Medal by the Royal Aeronautical Society for the development of the Fairey variable-camber gear. In 1942 he was in the United States as Director-General of the British Air Commission in Washington, and also as a member of the Joint Aircraft Committee and combined Aluminium/Magnesium Committee. He was created an M.B.E. (Civil) in 1920 and was knighted in 1942. He was a Commandeur de l'Ordre de la Couronne (Belgium), a Fellow of the City and Guilds Institute and was awarded the Medal of Freedom with Silver Palm (U.S.A.).

The first Fairey aircraft built to original designs was the F.2 fighter of 1916. This was followed by outstandingly successful seaplanes, including the Hamble Baby (an adaptation of a Sopwith design), the Campania and various models of the "Type III." When, to mark the company's fortieth anniversary, the history of the Fairey range of aircraft was described in detail in *Flight* for July 22, 1955, it was remarked that from the Series III were developed the IIIA, B, C, D, F, Gordon and Seal. Production of these versatile biplanes continued—in metal and with various engines—until the 1930s. The Atlanta and Titania flying-boats of the early post-war years were, in their day, the world's largest, and the sturdy little Flycatcher was one of the most popular of Naval fighters. It was the Fox I day bomber of 1926, however, with which the name of Richard Fairey will always be immediately associated. This beautiful biplane incorporated American design features and used an American engine, and Sir Richard would recall that when work started on its development—as a private venture—there was no more than £7,000 in the "kitty." This increased, but by the time the Fox had made good its promise, all had gone. It was then that Lord Trenchard came to the rescue with a contract for one squadron of Foxes, and this unit—No. 12—repeatedly eluded the defenders in air exercises. The Fox was progressively anglicized and "metallized" and important foreign contracts were secured for this and for the Firefly biplane fighter. Belgian acceptance of these types led to the establishment, in 1931, of Avions Fairey as a Belgian subsidiary. Of two Long-Range Monoplanes built, one gained the world's long distance record with a flight of 5,340 miles. Another notable Fairey monoplane was the Hendon night bomber.

In the late '30s the Battle bomber was produced for the R.A.F. and the Swordfish and Seafox for the Fleet Air Arm. The P.4/34 bomber was evolved into the Fulmar fighter, and important contracts were also secured for the Swordfish and Albacore. Dubbed "Stringbag," the Swordfish was one of the most popular and effective machines of the Second World War. There followed the Barracuda torpedo monoplane and the Firefly fighter, the latter being developed into an anti-submarine aircraft pending the introduction of the turboprop Gannet as now in service. In 1946 appeared the Stooge missile, and a year later the Gyrodyne helicopter, which established a speed record for its class. The Gyrodyne was later converted to the Jet Gyrodyne (described in this issue), and this machine is the precursor of the massive Rotodyne, now coming through the shops. In 1947 V.T.O. delta-wing rocket-propelled models were built, reproducing the characteristics of the F.D.1 research aircraft, flown in 1951. In 1954 the F.D.2 supersonic research machine was first tested, and on March 10, 1956, this was to astonish the world by raising the international speed record to 1,132 m.p.h.

A Fairey masterpiece: a "Flight" photograph of the Fox I day bomber.



***ROTOR KITE:** This helicopter-type "Hydro-Glider" has been providing sport at Cypress Gardens, New Haven, Fla., a popular aquatic entertainment centre. In effect a kite, the device becomes airborne when towed by a motor-boat, and if the towline is cast off it will descend safely by autorotation. The idea is not new: it had a war-time application in the Focke-Achgelis 330, a man-lifting rotor-kite towed by a U-boat for reconnaissance purposes.*

HERE AND THERE

Royal Departure

IN order to join the royal yacht at Mombasa for his journey to Australia for the Olympic Games, the Duke of Edinburgh will leave London Airport on October 15 in B.O.A.C. Argonaut G-ALHD *Ajax*. The Duke will be making extensive use of aircraft during subsequent stages.

Kangaroo on the Spot

THE Australian Minister for Air, Mr. Athol Townley, announced last week that in future R.A.A.F. aircraft are to have "leaping kangaroo" insignia in place of the central red spot of the existing roundel.

B-52s Under Surveillance

FOLLOWING an accident on September 17 the U.S.A.F. grounded all its B-52s. A week later the restriction was lifted, but special orders for "specially rigid pre-flight inspection" were issued.

H-21s for Germany

AN order for twenty-six H-21 helicopters from the Vertol Aircraft Corporation has been placed by the West German Defence Ministry. The Weser concern at Bremen has acquired European rights for overhaul and repair, with an option to build under licence.

Dousing the Downs

OVER 100,000 acres of linseed, barley and other crops at Darling Downs, Queensland, Australia, are to be sprayed by aircraft to protect them from cutworm, grubs and other insects. Twenty-four Tiger Moths will be used, their pilots operating from farm paddocks and each spraying about 1,400 acres a day. This year's record operation is expected to cost the farmers nearly £100,000.

Canal Pilots to Note?

FROM M.T.C.A. *Civil Aviation Information Circular* No. 115, September 26, 1956: "As the requirements of the Egyptian authorities are at present liable to alteration, operators are advised, until further notice, to obtain the up-to-date position from the Ministry of Transport and Civil Aviation. . . ."

U.S.-U.S.S.R. Arctic Research

THERE are to be co-ordinated photographic-survey flights by American and Russian aircraft over the Arctic from Nome, Alaska, and from Murmansk during the International Geophysical Year. The principal aim is to study "the dynamics of flow of ice in the Arctic basin."

Ohm-made

AN American light aircraft called the Ohm-Stoppelbein recently covered a 100 km closed-circuit course at 187.922 m.p.h. in the hands of one of its constructors, Richard Ohm; a world record is being claimed. Though weighing—whether empty or loaded is not stated—only 543 lb, the machine is reported to have an 85 h.p. engine.

Netherlands Parachuting

HITHERTO parachute jumping has been forbidden in Holland except on special occasions or in emergency, but now regulations licensing parachutists are being drawn up by the Dutch civil aviation authorities and a training school is to be established at Arnhem. It will help to train jumpers for the Dutch Red Cross parachute corps.

Vuia Commemorative Stamp

THE Rumanian air pioneer Traian Vuia (1872-1950), famed for having been during 1906 the first man in France to leave the ground in a passenger-carrying aeroplane with a wheeled undercarriage, has been commemorated by the issue in Bucharest of a single 55-bani stamp. Vuia's valuable achievements were described in an article in *Flight* for March 30, 1956.

Night Batsmanship Award

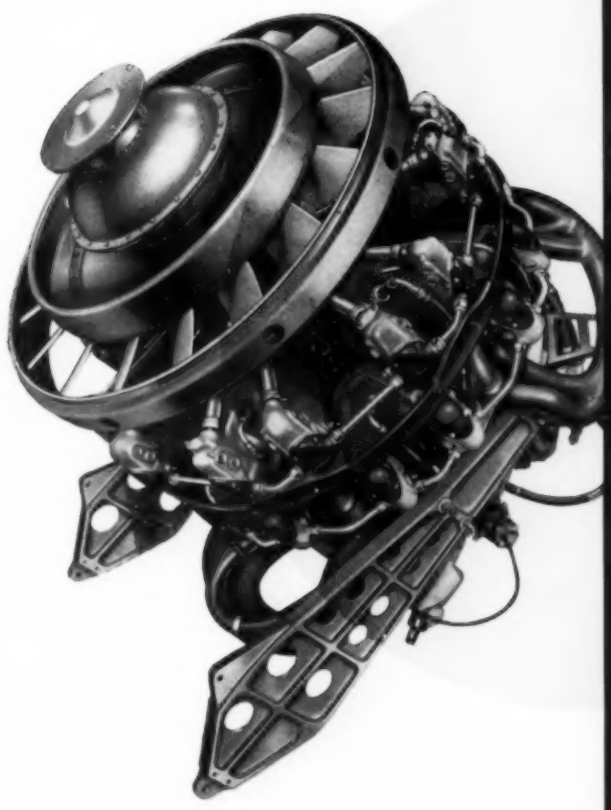
A CHEQUE for $200 and a letter of commendation from the Chief of the Canadian Naval Staff have been awarded to Lt-Cdr. S. E. Soward for developing an illuminated suit and bats which have been successfully used in night landings on the carrier *Magnificent*. The suit is said to be adequately visible to pilots from 1,000ft away, yet so arranged that it does not dazzle the batsman himself.

***CO-ORDINATION** of sales policy and methods within the Hawker Siddeley Group was discussed by this committee, whose members met recently at Manchester and afterwards toured the Chadderton factory and Woodford Aerodrome. Left to right are:—*
G. D. S. Garrett (Hawker Siddeley Group), C. A. G. Hicks (H.S.G.), C. J. Wood (H.S.G. representative in Australia), G. Anderson (Hawker), H. P. Wills (H.S.G. executive in South and Central America), P. R. Fowler (Air Service Training), R. F. G. Corse (Gloster), B. P. Hough (A.W.A.), D. W. R. Andrew (Avro), J. A. R. Kay (Avro director and general manager), C. S. Emery (A.W.A.), J. B. Caley (Avro), G. L. Humphrey (Avro Canada), D. James (Gloster), and P. Kidson (Avro).

Reliable Power

for Transports and Helicopters

Designed to meet the need for a more powerful yet equally dependable Leonides Engine, the 14-cylinder double-row LEONIDES MAJOR, with a diameter of only 39 in., is a direct development of the well-proven 9-cylinder Leonides which, amongst its many duties, has flown over ¼-million hours with Royal Air Force Flying Training Command alone.



ALVIS

Leonides MAJOR

870 b.h.p. radial

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MEMBER OF THE HAWKER SIDDELEY GROUP PIONEER...AND WORLD LEADER IN AVIATION

SIR HENRY ROYCE, Bart.

First R.Ae.S. Lecture to Commemorate the Great Engine Designer

A vivid representation of F. H. Royce in his original works at Cooke Street, Manchester.

ON the evening of October 1, at the Rolls-Royce Welfare Hall, Derby, the first Sir Henry Royce Memorial Lecture was delivered before the Derby branch of the Royal Aeronautical Society, the paper being given by Mr. Ivan Evernden, M.B.E., B.Sc. (Lond.), M.I.Mech.E., M.S.A.E., M.S.I.A. (Rolls-Royce, Ltd., Motor Car Division, Crewe). The lecturer dealt both with Sir Henry and with his achievements; but the latter having been described in a history given in *Flight* of May 7, 1954, it is proposed here to abstract Mr. Evernden's remarks on the personality of Sir Henry, the background of his work, and his enduring influence on those around him.

Mr. Evernden first met F. H. Royce in 1917 at St. Margaret's Bay, Kent, and from that time until his death in 1933 he worked for him and with him. "During those sixteen years," he recalled, "the manifestation of his uncanny gifts of accurate observation and logical deduction never ceased to astound me. Eccentric and somewhat incomprehensible as he was, I grew up regarding him almost as a father."

The lecturer went on to recall that by the time Royce was nine he had spent only one year at school. His father's business as a miller had failed. Leaving his wife to take care of herself, James Royce set out for London with his two sons, where Henry helped to swell the family purse by selling newspapers for W. H. Smith and Sons. When Henry was nine his father died, and he was left to the care of his mother, relatives and friends. An aunt eventually paid for his apprenticeship to the Great Northern Railway, and he entered the works at Peterborough in 1877. He had always shown a great liking for machinery and here he was able to develop his gift as a mechanic. He was helped by the Mr. Yarrow with whom he lived, who had a small workshop with a lathe. Three years later, Royce's aunt died and his apprenticeship ended. Royce set out for the North, armed with an excellent recommendation, only to find work hard to obtain. However, he found employment with a firm of tool makers in Leeds, where again he could develop his bent as a mechanic.

Failure soon befell this concern and Royce was back in London, working for the Electric Light and Power Co., who were pioneering in the lighting of streets and public buildings. It must have been here that he acquired a love for electricity, which he at once proceeded to study at night school. Such was the time in which he lived and his ability to learn quickly, that he was sent by his employers to be first electrician to their subsidiary company in Liverpool. Unfortunately, this company failed, and Royce was again unemployed. Although fortune seemed ever to stack her odds against him, in one respect that was not always so. Several times in his life, he was lucky to meet just the right person at the right time. This time it was to be Mr. Albert Claremont, who, recognizing his ability, lent him £50, which, with his own £20, enabled him to start a small business in Cooke Street, Manchester, for the making of electric bells, lamps and fitments. Entirely by the incessant effort of Royce, the business grew rapidly and extended into the manufacture of dynamos, motors and cranes. In 1894, "F. H. Royce and Co., Electrical and Mechanical Engineers" was formed, and this thrived for five years, when the depression due to the Boer War set in.

Royce, who was living at Knutsford, had bought a Decauville car, which caused him considerable annoyance owing to its lack of reliability and refinement. These failings he proceeded to rectify, much to the dismay of his partner who was struggling to keep the business alive. Motoring as a sport had existed on the Continent for some years, but had not until then spread to this country. To the further dismay of his partner, Royce announced his intention of building a two-cylinder car and, to this proposal, his partner hesitantly agreed.

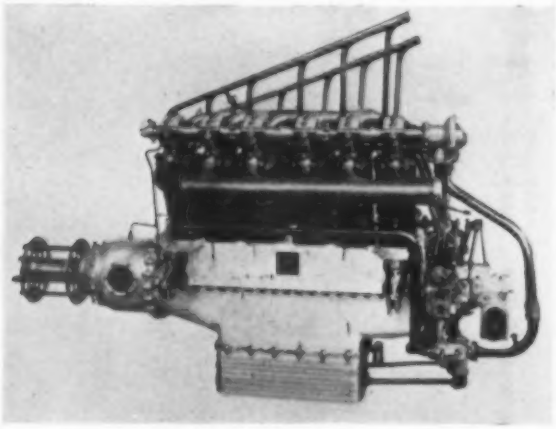
At this time in London there was a firm headed by the Hon. C. S. Rolls, the balloonist and racing motorist, engaged in the business of the sale of continental cars. In 1904, one of the early Royce cars, owned by Henry Edmunds, was shown to Rolls, who was so impressed by its qualities that the same year, after some difficulty, a meeting was arranged between Rolls and Royce in Manchester. Again Royce met the right man, at the right time. Rolls agreed to sell all the cars which Royce could make and he outlined a range for four models, all of which subsequently were produced, and which bore the name of "Rolls-Royce." A 20 h.p. Rolls-Royce was entered in the Tourist Trophy Race of 1905, gaining second place. The following year it won.

It was fortunate for Royce that the Hon. C. S. Rolls had with him, as partner, Mr. Claude Johnson, a founder of the Automobile Club. Johnson was to become famous for his foresight, his organizing ability and his unique flair for high-class salesmanship. Largely due to the efforts of a Mr. Briggs, who provided backing, the company of Rolls-Royce, Ltd., was formed in March 1906, under the directorate of F. H. Royce, C. S. Rolls, A. W. Claremont, Claude Johnson and A. H. Briggs, with a capital of £60,000. After the earlier Tourist Trophy, there followed a series of victories, the accent in each case being on reliability with silent and smooth travel. Rolls was able to sell all the cars that Royce could produce. Claude Johnson quickly realized the desirability of a one-car policy in order to relieve Royce, upon whom the strain had begun to tell, and to achieve the necessary production. Likewise, he realized that Cooke Street was too small for the programme he envisaged. So, in 1906, increased capital was acquired, again only by the generosity of Mr. Briggs, and to Royce fell the task of designing a new and ideal factory at Derby. As if that burden were not enough, that autumn Royce began the design of the car which eventually was to become the famous Silver Ghost.

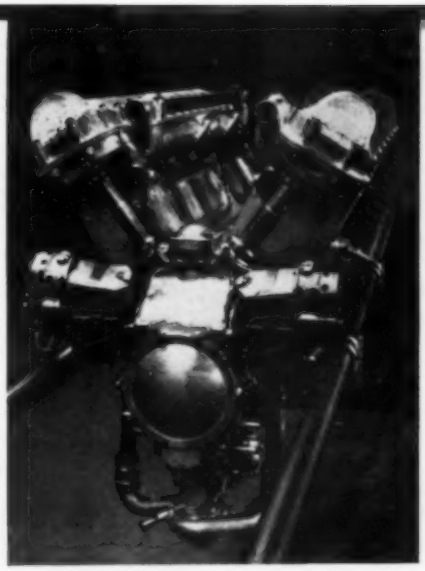
Perhaps the most significant period in the career of Royce and of the company which he founded was that dating from the opening of the Derby works in 1908 to the outbreak of war in 1914. Beginning with the 15,000 miles Reliability Trial under R.A.C. observation in 1907, success upon success was heaped upon the Silver Ghost which had earned the epithet, "The Best Car in the World." All this happened in the short space of less than 10 years. How was this made possible? Firstly by Royce, who was happy only when he was striving to make something a little more nearly perfect. Secondly through the guiding genius of Claude Johnson, who realized that Royce could produce something finer than had ever before been made, and that this could become the corner stone of his sales policy.

Rolls, restless, impulsive and forever seeking new adventures, became tired of motoring and took up flying; this time not in balloons or lighter-than-air machines, but in the aeroplane. He purchased a machine from the Wright Brothers, whom he met soon after the opening of the Derby works in 1908. Within a year his reputation as a flyer equalled that which he had acquired as a motorist, in which rôle he rapidly lost interest. His great achievement as an aviator was to make the first double crossing of the English Channel. A few months later, on July 12, 1910, at Bournemouth, the tailplane of the aircraft broke off and the machine crashed. Rolls died a few moments later. This incident had a profound effect on Royce who had a rooted objection to pioneering. Although Rolls had no doubt endeavoured to interest him in the mechanics of this new form of transport, Royce had strenuously resisted. Now he looked upon the aeroplane as having robbed him of his great colleague and collaborator. He gave no thought to the aero-engine until six years later, when war thrust it before him. But for that accident at Bournemouth, there might have been a different story to tell.

Perfection and idealism in the design and manufacture of a motor car, Mr. Evernden remarked, is praiseworthy; but it is



(Left) The "pre-series I" Eagle engine of the early days of World War I.



(Right) the first "F" engine, which in 1931 became the Kestrel.

SIR HENRY ROYCE . . .

a luxury which only a few can afford. These qualities are essential in an aircraft. Consequently, it was this industry that held great opportunities for the full growth of Royce's genius.

Fate, the lecturer went on, had not yet delivered its last blow. The years of toil with inadequate meals and insufficient rest and relaxation, which began in the early days in Manchester, and was only alleviated in the later years through the fatherly care of "C.J.," had taken their toll of Royce's strength and he became seriously ill. Realizing all that was at stake, C.J. took control, and Royce was taken to specialists. Largely due to Royce's persistent willpower, he gradually recovered strength. Again C.J. took no risks. After taking Royce through France and Italy, they wintered in Egypt, and in the spring went to the South of France. Here, at Le Canadel, C.J. built a villa for Royce in which he could spend his winters. He also acquired a residence in Crowborough, Sussex, for summer use. The great man was never to go back to Derby and the battle of industrial life. Instead, he was to gather around him a few people with whom he could carry on his work. Close to the Villa Mimosa at Le Canadel, there was built an office to house the staff—"the Bureau." The first occupant was Mr. A. G. Elliott, C.B.E., late vice-chairman of Rolls-Royce, and erstwhile chief engineer, and also Mr. Maurice Olley, later to become famous in the automobile industry of the U.S.A. Next C.J. found Royce a permanent home in England at St. Margaret's Bay, near Dover. The house was about half-way down the road to the bay, with a view from the cliffs across the Channel to France. This house, Mr. Evernden understood, was demolished by enemy action in the Second World War.

Just when life for Royce at last appeared to have become settled, fate struck another blow. Royce was taken seriously ill in December 1912, when at Le Canadel, and had to be rushed to England for a major operation. Again the care of C.J. and the courage of Royce won the battle, but it was obvious that great care would be necessary if this valuable life were to be preserved. From the nursing home where Royce had recuperated from his earlier illness, C.J. obtained a nurse to keep watch over the great man, and Miss Ethel Aubin stayed with him until he died.

In an address to aeronautical engineers, said the lecturer, such a detailed account of the early life of Royce and the birth of the car industry which he founded might seem out of place. However, he had given it to make two points. The first was that every event in his life during that period had a profound effect on the development of his genius. The misfortunes of his youth, although depriving him of the education he might rightly have deserved, had the virtue of forcing him to become first a mechanic, then an engineer. "This," said Mr. Evernden, "is a method of approach which, until recently, has been growing less in favour and more difficult to pursue. I am glad, therefore, that the scheme of technical education for engineering personnel in the plant, sponsored so vigorously by Lord Hives, who, as 'Hs,' was for so many years the complement of Royce, now is a reality. It is a grim thought that, with our present system of education, where children are fed with knowledge, filtered at intervals, and the residue passed off through selected channels, dependent upon the results of an examination, Royce might have failed at the first filter, and would never have risen above the rank of a mechanic. This is equally true of other similar great men, like Henry Ford and Lord Nuffield. The second fact is, that had not Royce and his associate, Claude Johnson, built up the motor car engineering firm of Rolls-Royce, and gathered together such people as Ernest Hives, Tom Haldenby, Eric Platford, Arthur Wormald, A. G. Elliott, to mention only a few, there would not have existed in 1914 the organization to design and develop, in but a few years, the aero-engines which were to play such an important part in bringing victory to this country in the 1914-18 War."

Royce was a unique personality. Tall and erect, he had the shape of head which we associate with a scholar. In his days at Manchester and Derby, he had been a great taskmaster, expecting from his workmates the same devotion to the job that he himself would give. He was intolerant and of hasty temper. He would instantly dismiss a bench hand for the incorrect use of a file. Next day, having forgotten, and finding him absent, he would send for him to come back.

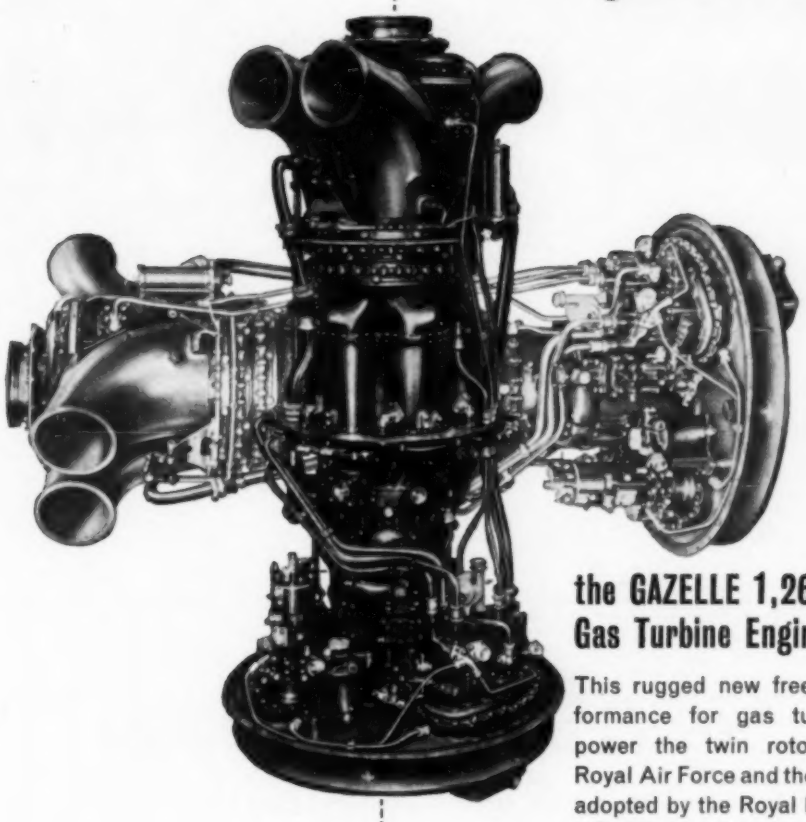
He never took part in any pastime or sport; his recreation had been his work. Although he married in 1905, he had no children. Later, Mr. Evernden formed the opinion that his attitude towards life might have been modified if he had been blessed with a family, for he was uncannily popular with children and had a way of charming them. He did not smoke and, in those days, did not drink strong beverages. Although he made the "best car in the world," he never motored for pleasure—except for the thrill of trying out some new feature.

Having declared war on Germany, the Government apparently had no very clear idea of the part the motor car and the aeroplane could play in the struggle, or even of the contribution that could be made by the new industries they had created. Armament manufacture was confined largely to armament firms. Some people honestly believed that the motor car and the aeroplane could be of little use in war. However, cars were provided for staff use and many Rolls-Royce cars were rebuilt as armoured cars. This alone could not keep the Derby factory fully occupied and many of the personnel joined the Forces, in some cases only to be brought back later. After making *flechettes* and shells, the company was asked to manufacture the Renault aero engine; but it was inevitable that Royce and his team would not rest content for long with the making of engines, the design of which offended the very tenets of their doctrine. At this time Royce was at St. Margaret's Bay, with a staff including A. G. Elliott and Maurice Olley. As early as August 1914 design work started on an aero-engine having 12 liquid-cooled cylinders. The prototype ran on the test bed at Derby in February 1915. E. W. Hives was in charge of the experimental department and it was a great day when he saw the engine first run and could report to Royce that already it was developing 25 h.p. more than he had predicted. This engine, named Eagle, was the first of an illustrious series.

The lecturer went on to trace the development of the Eagle, the Falcon and the Hawk, and continued: "Early in 1916, I was directed to work for Rolls-Royce, Ltd., by the Ministry of Munitions. I joined the Airship Design Office at Derby and soon learned of the mythical yet powerful personality bearing the name of Royce. The more I learned of his work, his ideals and his teaching, the more determined I was to meet him and eventually, if at all possible, to become a member of his select team. My chance came in the summer of 1916. I wasted no time in going down and arranging to be introduced to him. I met him in the village, returning from a walk to collect pinecones for burning in the household grates to save coal. A tall and erect genial man he was like a country squire, with a soft voice and rather piercing eyes that seemed to look right inside one's mind and to read one's thoughts. During conversation I had the opportunity of conveying to him my wish to work with him some day.

Not long after that time, life became rather hectic in the little village on the cliffs. Shells from long-range guns crossed the Channel, aeroplane raids were made on the Channel fortifications and a nearby town, while coastal guns frequently fired across the bows of unidentified Channel shipping. Anti-invasion precautions caused Elliott to be arrested one night returning home late from work. A new home was found for Royce and his staff at West

Selected by the Royal Navy and the Royal Air Force



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This rugged new free-turbine engine of notable performance for gas turbine-powered helicopters will power the twin rotor Bristol 192, adopted by the Royal Air Force and the Westland "Wessex" helicopter, adopted by the Royal Navy.

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CRC 03

Concentration on design

It is basic airline economics that aircraft don't earn money while they're on the ground. Therefore, time spent on the ground even for essential fuelling, must be cut to the minimum. It was with this object in mind that BP Aviation Service designed the most up-to-date mobile fueller in the world—the Cornwall Fueller.

The Cornwall's performance is impressive. With its trailer it has a maximum bulk capacity of 5,900 Imperial Gallons. It can deliver fuel at up to 500 gallons per minute and pressures of 50 lb. per square inch.

But safety has not been overlooked in the design of the Cornwall. Fine particle filters are incorporated to prevent foreign matter entering the fuel, while the tanks are lined with synthetic resin as an added precaution.

This concentration on design which has produced the new Cornwall Fueller has made a notable contribution to the efficiency of BP Aviation Service. Now more than ever, BP Aviation Service meets the requirements of the most modern civil aircraft.

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SIR HENRY ROYCE . . .

Wittering, in Sussex, a very small village on the Channel, on the west point of Chichester Harbour, opposite to East Beach, Hayling Island. The house "Elmstead," which was a rather long, two-storey building, one room thick, with a wing each end, had a lovely old English lawn in front and a large garden, as well as several acres of meadowland. Two small reception rooms were set aside for the design staff, headed by Mr. Elliott, and including Chas. Jenner and S. F. Pottinger. Upstairs was the secretary's office, adjacent to the "Old Man's" bedroom. In the early days he was affectionately known as "Pa Royce." In later years as a term of endearment, he was always spoken of by his staff as the "Old Man."

In 1918 Mr. Evernden was privileged to get a glimpse of this remote brain centre, when he was asked to join the staff. "Arriving at Chichester around midday," he recalled, "I made my way by carrier's van to the village and put up at the Dog and Duck. After tea, I was invited to go up to "Elmstead" for the evening. In the little office illuminated by large circular-wicked lamps, cream papered walls, and coconut matting floors, a conference was in progress on the design of the nose bearing of the Eagle reduction gear. The problem was to provide a means of rapidly setting this bearing in line with the crankshaft after an engine overhaul consisting of the fitting of new main bearings. The session ended only at 10 p.m. when Miss Aubin came in to suggest that it was getting very late. Thus was evolved the double eccentric mounting for the nose bearing with vernier setting.

Royce had peculiar but logical ideas. For example, one worked in the morning, had several hours leisure in the afternoon, and after having tea with him at about 4.30 p.m., one worked on until 8 p.m. or even 10 p.m. His idea was that more benefit could be derived, especially during the shorter days, from leisure in hours of daylight when living in such a remote locality.

"Sorry I was," continued Mr. Evernden, "not to have made good—but with Royce one never knew. Although I had been groomed for the occasion under the experienced tutorship of Hs., I must have created a bad impression, or worn the wrong clothes."

The lecturer went on to recall that the period after the Armistice held great problems for the management, but they were in the aero-engine business to stay.

Mr. Evernden then described the development of the Condor mentioning, incidentally, the supercharged Series V, not referred to in *Flight* of May 7, 1954. He referred to late marks of Eagle; a "new Eagle" of January 1925, having 16 cylinders in X formation; the Kestrel; and the Buzzard.

The speed with which these new projects were conceived was made possible only by a design team built up in Derby by Royce under the guidance of Mr. A. J. Rowledge, who had joined the company at about the end of the war and, by the development team under Mr. Hives. Royce believed in team work. Almost weekly visits were made by Hives and Rowledge to West Wittering, to discuss designs, and the results of tests. When the weather was fine, these conferences took place in the shade of the mulberry tree at the end of the lawn at "Elmstead."

During preparations for the Schneider race of 1929, Mr. Evernden went on, visitors were frequent at "Elmstead," and life for Royce became changed for a while. Of retiring disposition as he was, Royce was persuaded to go round to Calshot on several occasions to see the work of preparation for the race and to meet the pilots. Strangely enough one of the turning points of the course for the race was in the village and Royce watched the race from a haystack on his farm.

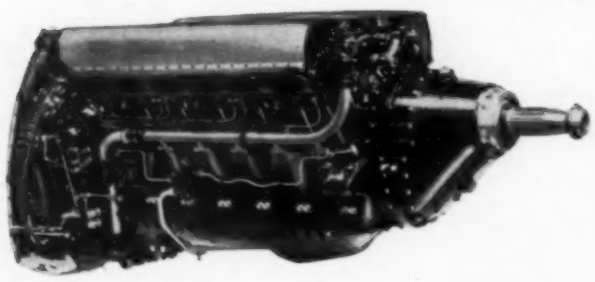
Elated as he was with the victory, his chief emotion was one of relief that no pilot had lost his life in the contest. The stress and strain had taken their toll and he was confined to bed for several days.

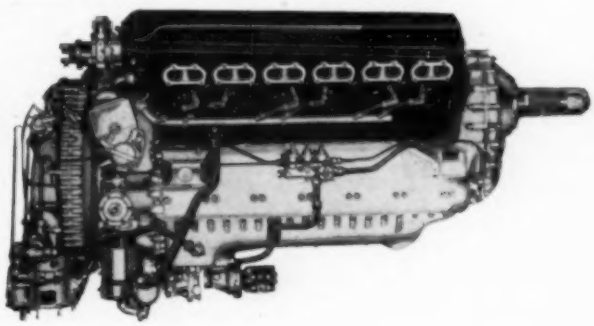
Tea under the mulberry tree at "Elmstead," West Wittering, where much of the development work on the Schneider Trophy engines was done: F. H. Royce, C. L. Jenner, and E. W. Hives, now Lord Hives. (Above) Royce with Schneider Trophy pilots at Calshot in 1929.

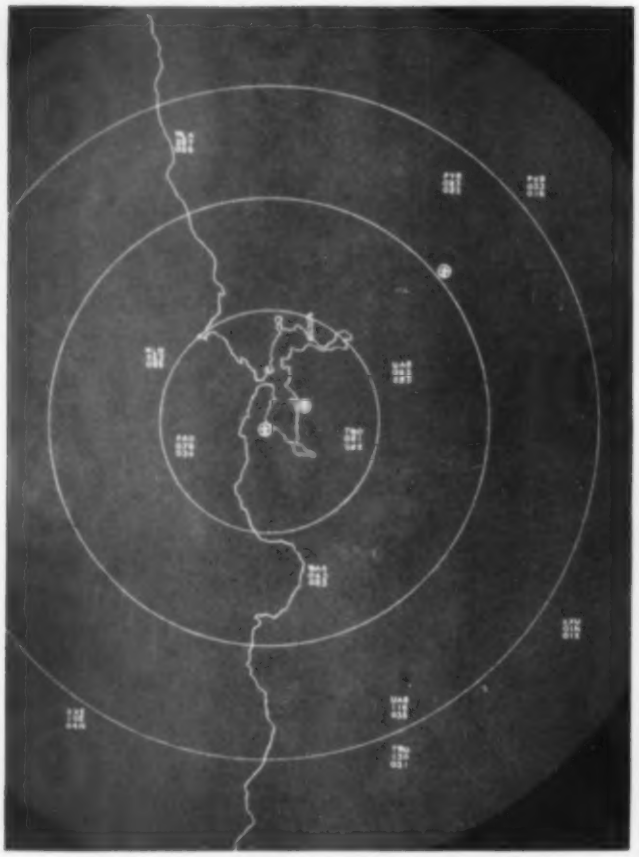
In the Birthday Honours of 1930 Royce was created a baronet. Towards the end of 1932 the company was embarking on the development of an engine—the Merlin—which was to carry "the magic of a name" into the great battles of the Second World War. Sir Henry's health would not permit him to journey to his villa on the Riviera for the winter of that year, and much of the early part of 1933 he spent in bed. Even so, he was not inactive mentally and would give "audiences" in his room, study current designs and send back handwritten instructions. For some years he had taken an interest in farming and had acquired some 70 acres. He decided to build a cottage and made a detailed specification which he showed Mr. Evernden on April 13, 1933; but he died on April 22.

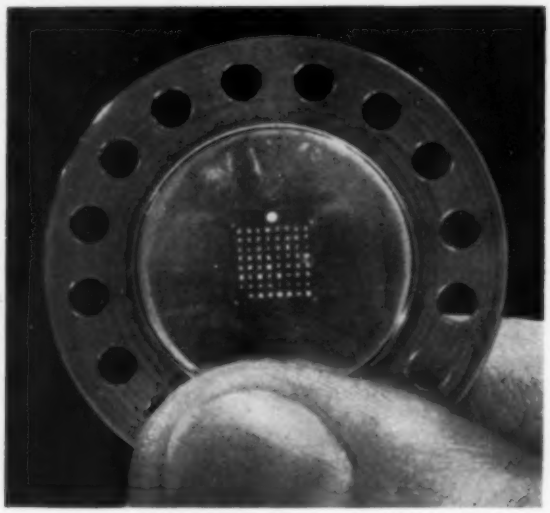
Among Mr. Evernden's concluding remarks were these: "Essentially a mechanic, he was suspicious of academic learning, and regarded it as just another tool in the tool box, to be used only as a last resort . . . Of the many great achievements of his life, perhaps the greatest of all was the building of a unique engineering organization which would enable his work to go on; that body of engineers, dedicated to uphold and to practise his doctrines."

The "R" engine (left), having proved so successful as a racing unit, was developed into the P.V.12, a private venture which was later—after the death of Sir Henry Royce—adopted by the Government and produced in vast quantities as the world-famous Merlin (right).









A typical Charactron traffic-movement display, with coded information groups showing aircraft positions. (Top right) A controller at the Charactron console. (Right) The matrix, or "stencil," by means of which the code-group is displayed on the screen.

CHARACTRON

—*for Civil Air Traffic Control: an Ingenious Reporting System*

AN electronic display device designed to help in solving the increasingly complex problem of air-traffic control is now in production by Stromberg-Carlson, of San Diego, a division of General Dynamics Corporation.

The device is a commercial version of the Charactron "shaped-beam" tube which has been used for some time in the SAGE system of military aircraft surveillance. The new tube, which has a 19in-diameter screen, will be useful both for civil and military air traffic control when combined with appropriately modified control panels, radar, and electronic computers.

In addition to indicating the relative positions of aircraft and showing movement across a map-diagram, the system employing the Charactron shaped-beam tube actually displays letters and numbers to represent such information as the flight number of the aircraft, and its speed and altitude. All this is superimposed on a line diagram of the airfield area, thus eliminating all non-essential geographical shapes ordinarily shown by radar screens.

Each group of numbers and letters moves on the map-screen in relation to the aircraft track, and the characters in each group change as often as necessary to provide current information. Thus, with the aid of duplicated radar sets, a traffic controller can assimilate a tremendous amount of information.

Charactron is essentially a method of displaying letters and numbers on a cathode-ray tube. Superficially, the screen resembles that of a conventional television tube. Electrons are projected through a minute stencil-plate cut with the characters to be reproduced; then, when the electron beams strike the fluorescent screen, they give a visual reproduction of the letter. The location of each character on the screen can be exactly controlled.

One of the advantages of Charactron is the tremendous speed with which it can reproduce information fed into it through a system composed of computers, radar, or other data sources. The new 19in tube can reproduce letters, numbers, or specially designed characters at a rate of more than 10,000 per second. Because each is formed by a carefully engraved opening in the stencil, fidelity of reproduction is uniformly high; it is, in fact, comparable with that obtainable in conventional letterpress printing.

The typical display on the face of a Charactron tube shown in the illustration (top left) portrays the San Francisco bay region, and 12 aircraft that are within radar range. Each group of nine characters is referred to as a "target format," the centre of which corresponds to the target's position in range and azimuth. This information is supplied by the radar set, and is merged with the other pertinent facts in a computer and storage device. This equipment then transmits the target format information to the Charactron console.

One way in which the nine-character format might be coded is as follows:

Operator: United Airlines ...	U A 6	}	Flight No. 665
Altitude: 6,000ft. ...	0 6 6		
Speed: 200 m.p.h....	0 2 5		

Charactron is typical of many new techniques being used in the vast SAGE system referred to above. Eventually, SAGE will deal with all control and reporting work in America's air-defence network, facilitating automatic plotting and exchange of target information between control centres. It is certainly the most ambitious technique of this kind yet attempted.

Fireflash

FAIREY

WEAPON DIVISION

Tests now in progress with the Fairey Fireflash, the first British air-to-air guided weapon, are adding still further to the Hawker Hunter's operational versatility. Readily adaptable for either high altitude interception, low level close support or ground attack duties, the Hunter is the standard fighter of the Royal Air Force and NATO Defence Forces.

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ELECTRO-HYDRAULIC SAFETY STOP, ELECTRO-THERMAL DE-ICING

Duncansby Head lighthouse, John o'Groats, seen from Auster G-AIJM through a gap in the on-the-deck stratus. The account of the flight on this page is by the pilot of the aircraft, Harold Best-Devereux.

On Chasing Egbert

—*from Land's End to John o'Groats: the "Fuel Wager" Pilot's Story*

MOST readers will have read of the recent wager between the Royal Aero Club and the British Automobile Racing Club that a light aircraft could fly from Land's End to John o'Groats and back to Elstree Aerodrome, using less petrol than a sports car. Whether any useful purpose is served by such an exercise is only for the individual to decide; perhaps everything we do should, in these days, have a serious purpose—or should it?

Naturally the result of such a contest can be juggled to suit any point of view, depending on the type of vehicle used. A Druine Turbulent matched against a Ford Zephyr would have a similar advantage to a Minicar competing against a Proctor: both examples are equally one-sided. It was decided, therefore, that seating capacity, brake horsepower and speed were to be as similar as possible; the car was to be British, and so was the aircraft. This latter point raised a difficulty, particularly as the Royal Aero Club felt that a post-war aircraft should be used. The best bet seemed to be the Auster J4, a very pleasant little two-seater tourer of 1947 production and fitted with a Cirrus Minor I engine. Fortunately, just such an aircraft was readily available and its owner did not need much persuasion to agree.

An immediate problem posed itself as to how standard is standard—should the silencer stay on or not? Should some "standard" small wheels be fitted? What about a coarse-pitch airscrew? These and a host of other possibilities were explored. The results of a survey of the aircraft were promising, there being several parts where large assembly tolerances left gaps and holes which could be closed up, with consequent improvements in both airflow and appearance. A local Popular Flying Association Group, the Hatch End Ultra-light Aircraft Constructors Club, immediately offered assistance, and with their help the elevator, rudder and tailplane gaps were sealed and the lift-strut ends bound with tape. Small items such as jury-strut ends had holes sealed with plastic wood and the gaps at the aileron roots were filled to the minimum tolerance. Flight tests to check fuel consumption showed a small improvement in performance. On the engine side it was not possible to obtain a mixture control, although useful advice and figures were obtained from the Cirrus Engine Division at Blackburn's. From a short series of flights it was possible to measure exact fuel consumption at various power settings and plot these on a graph. The true airspeed was plotted against r.p.m. and from these two graphs it was possible to establish the best power setting and airspeed for any condition of headwind or, hopefully, tailwind.

The flight from Elstree to Land's End justified the calculations and an average of 27 m.p.g. was achieved for a total consumption of a fraction over ten gallons. The associated wind conditions for this flight were approximately a three-knot headwind component for about 20 miles, followed by a progressively increasing wind which started at about five knots at 100 deg and changed steadily to 15 kt at 160 deg.

On this basis, taking a track from Land's End to Lundy Island, and thence direct to Turnhouse, there seemed every possibility of equalling, if not improving on, the car's performance. This dog-leg track was considered more prudent than trying to follow a straight course which, surprisingly, would have been mostly over water.

That was not to be, however. The contest started at one minute past midnight when Lord Essendon, accompanied by Maurice Imray, drove off from Land's End into the teeth of a gale, followed by a Vanguard brake with the co-driver, Lord Selsdon, being transported horizontally in bed surrounded by sealed tins of B.P. and other essential fluids.

Land's End is probably a nice enough spot—that is, if one is a keen amateur meteorologist on holiday, seeking waterspouts. To a somewhat jaundiced eye the airport appeared to consist of a handsome brick-built fire station with a small grass landing-strip.

However, to get away from Land's End—ay, there really was the rub! Every meteorological condition except sandstorms seemed to have been superbly organized in the interest of the little red car racing ahead. Inside the Triumph was the moronic average-speed computer "Egbert," a fine example of automation for motorists, ticking away with his twin pointers gleefully showing that overdrive is a coming thing!

Following an abortive attempt to leave St. Just, success was finally achieved by creeping quietly along the North Cornish coast and on track to Rearsby. As the weather to the north and west was hopeless, Rearsby had been decided upon for fuel. Following a quick lunch with Ranald Porteous a bee-line was made for Perth *via* Woolsington and Drem, involving a further 3 hr 20 min and making a total for the day of seven flying hours. At this stage it was fairly obvious that the result was a foregone conclusion. The Airwork organization at Perth co-operated to make a very pleasant overnight stop.

The prospect of a direct flight over the Highlands from Perth to John o'Groats was knocked on the head by the shocking visibility; so, although it meant throwing fuel away, a bad-weather route was picked towards Dyce. At Edzell conditions had improved slightly, so a timorous creep was made on a semi-circular track as far as Kinloss—where the sun shone, but with little effect on the prevailing "Scotch mist." Naturally it had been hoped to "see" the scenery and, from Dornoch to Wick, the appetite was whetted for further excursions by air in this direction. The immediate object of finding the lighthouse at Duncansby Head and flying around it (as required by the rules) seemed likely to be foxed by an area of coastal stratus north of Wick. Thinking of Egbert's horrible smug needles soon forced a decision and, after a period of D.R. flying, some patient circling was rewarded by a view of the white lighthouse modestly peeping through the cloud.

The starboard window, hotly pursued by a sprig of Cornish heather sucked from the instrument-panel coaming, fluttered down as a result of the combined wriggling of the two occupants of the Auster to enjoy the view; and so back to Dalcross for fuel.

Dalcross handled the Auster very briskly and it required but 25 minutes from landing to be airborne again and climbing steeply to view the mountain tops in relation to the top of the murk. The result was much as anticipated, with the valleys covered in cloud and so, as we were not unduly long-necked, a mutual agreement with passenger Geoffrey Sykes (observing for the B.A.R.C.) was made that he should read his quarter-inch map and watch that the starboard wing was not likely to spoil its new paint rubbing hillsides, while I was to follow a similar proceeding to port. This system worked very well down past Kingussie and Blair Atholl—where surely there was the ghost of a Dunne biplane somewhere. The intention to continue to Turnhouse was forgotten after an hour of creeping along, and a quick dart was made back into Perth for an excellent supper in the club.

Thursday, September 20, seemed worse than the previous day and the fog looked like holding. Spirits sank when the met. from Edinburgh to the south gave visibility as only 400 yd, but at lunchtime an upper-air clearance gave sufficient visibility at least to have a look at the situation.

Although unpleasant enough, a flight plan was worked out avoiding likely traffic and bearing in mind the quadrantal rule as far as Tyneside. Here visibility improved until, over the Tees, a fairly rapid clearance came about, giving up to eight miles in parts. In the better visibility, height was reduced because of the headwind. The effect of the late afternoon reduced visibility again and the London Zone was entered down the free lane to Elstree, which was reached 5 hr 20 min after leaving Perth and having used 17½ gallons of fuel—quite enough, both in time and fuel.

What of it all? Perhaps nothing very useful to the cynically minded. For the Royal Aero Club and B.A.R.C. it was an opportunity to have some fun and stir up a few thoughts for the future. One thing the affair did show is that the R.Ae.C. is not asleep to the need to stimulate interest in private flying, and that they chose a novel way to bring home to a very wide public that an average sort of light aeroplane can achieve over 20 m.p.g. in adverse conditions.

That all being as it may, thanks are due in particular to Col. Preston and John Crammond of the Royal Aero Club committee, who thought up the scheme, for their generous support and confidence. Acknowledgements are also due to the sportsmanship shown by the participants (*not* including Egbert) and the B.A.R.C. committee who so generously donated their £50 winnings to the Guide Dogs for the Blind Fund. H. B-D.

Vancouver's seaplane base: Cessna and R.C.A.F. Otter.

A charter company's Beaver taxies in at Vancouver.

Passengers' first sight at Vancouver's main terminal.

T.C.A. North Star and C.P.A.L. and P.W.A. DC-3s on Vancouver apron.

T.C.A. Super Constellation approaches Gate 2, Vancouver.

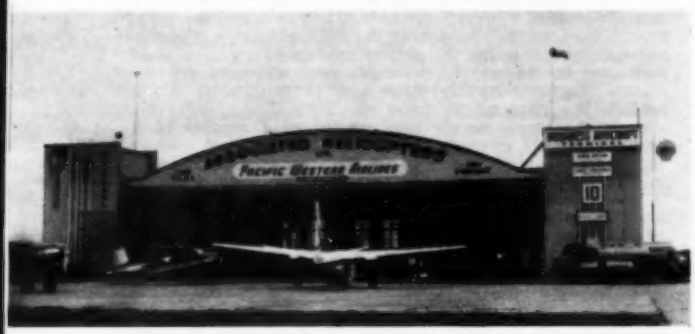
The apron scene, Vancouver, as a Convair of C.P.A.L. taxies in.

Trans-Canada Network

"FLIGHT" PHOTOGRAPHS

Saskatoon terminal, seen from a T.C.A. North Star.

View from Edmonton tower; original airport hangars in distance.



Edmonton's "business aircraft terminal" hangar.

Municipal airport terminal building, Edmonton.

CANADA'S high dependence on air transport stems basically from the large inter-city distances involved and, in the vast northern areas, from the nature of the country. Some of the airports which serve as staging posts on the coast-to-coast journey are illustrated in the selection of *Flight* photographs on these two pages. Viscounts and North Stars of Trans-Canada Air Lines; Convairs and Dakotas of Canadian Pacific and Pacific Western; the private, charter and company seaplanes at Vancouver (and even the startling space-ship outside the main terminal there)—all form part of today's trans-Canada network. From west to east, the airports depicted are Vancouver; Edmonton; Saskatoon; Winnipeg; Fort William; and Toronto.

Lakehead Airport, serving Fort William and Port Arthur.

T.C.A. Viscount at Malton.

T.C.A. Viscount maintenance dock at Winnipeg.

VANGUARD FREIGHTER PROJECT

Twenty-ton Cargoes at 400 m.p.h.

OUR Farnborough report of September 7 included, in a review of aircraft to be seen at the S.B.A.C. Show, a reference to a freighter version of Vickers' turboprop Vanguard. The project was displayed in model form on the company's stand in the static exhibition.

The Vanguard's large cabin volume and capacious under-floor freight capacity were designed to assist the operating airlines to smooth out the effects of seasonal passenger traffic peaks by providing capacity for additional revenue from air-freight; and the step to a pure cargo version, while not involving any major structural changes, has been envisaged as a variation of the Vanguard design rather than an interior rearrangement for a different operating rôle. The project under consideration—it should be made clear at the outset that the freighter version envisaged by Vickers is a design-study rather than a specific design—would appear to make commercial common sense both to Vickers and to customers whose cargo-lifts are over short- and medium-haul stages. The analysis which follows is of the operating potential of a Vanguard modified to carry a 40,000 lb payload within the existing fuselage.

The air freighter's requirements of speed and extreme operating economy—weight-for-weight cargo rates are rarely greater than half the revenue earned by passenger traffic—are to be found in good measure in the stripped-out Vanguard. The estimated operating costs are remarkably low, and the total available cargo volume (7,110 cu ft) is large, even by comparison with the Blackburn Beverley (7,500 cu ft) and the Lockheed C-130A Hercules (4,300 cu ft). The adaptation of the passenger airliner airframe for freight necessarily involves the use of side-loading doors, and the size of 9ft wide by 5ft 6in compares with the 10ft 4in wide, 7ft 6in high doors of the DC-6A. Loading is not, however, confined to the one side door; the generous (5ft 6in high) belly hatches—as on the standard airliner—provide access to the capacious underfloor holds.

The conversion of the Series 950 airframe is assumed to consist primarily of removing from the cabin as much of the equipment and as many of the installations as possible and making use of the higher powers that will be available from the Rolls-Royce Tyne in its later stages of development.

To obtain the maximum usable volume for freight stowage, the analysis assumes the removal of both the forward and after pantries, the associated electrics (estimated as approximately 300 lb total weight), all the passenger seats, passenger life-belts, cabin furnishings, bar, wall linings, service panels and soundproofing. Furthermore, the bulkheads which partition the long Vanguard pressure cabin into three passenger cabins would be removed, although the forward one at the end of the flight deck compartment would be retained.

The operational rôle of the freighter version permits further economies to be effected in the provision of crew and passenger facilities, and further weight and space saving would be achieved by removing the cloakrooms and the forward toilets (leaving one toilet aft) and substituting for the domestic water supply a two-gallon drinking water flask in the flight deck compartment. The folding air-steps which are integral with the aft passenger entrance door could also be dispensed with. The internal working space cleared by removal of these items of equipment is considerable and Vickers anticipate that, with the payload carried, ample freight segregation and working space will be possible. In terms of bare dimensions the 5,700 cu ft of volume available above the floor is 86ft 3in long, 9ft 11in wide at its maximum point and up to 7ft 8in high.

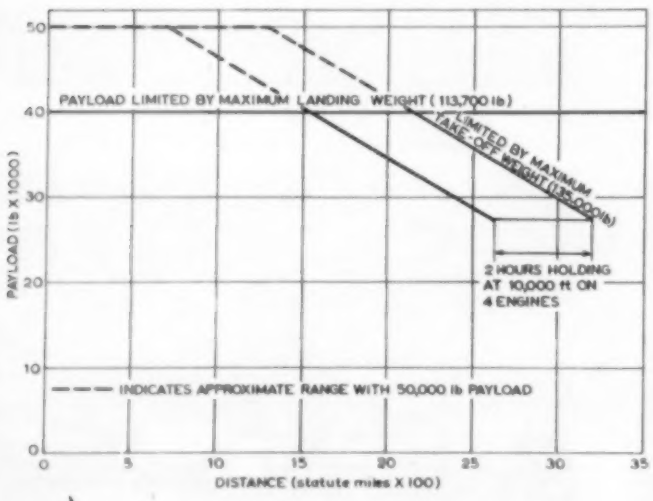
The structural changes considered necessary for the freighter project are the provision of a stiffer floor and the addition of a power-operated upward-opening door immediately aft of the present passenger entrance for loading purposes. It is proposed that structural reinforcing would be adopted to accommodate a loading of at least 150 lb/sq ft in all the cargo compartments. The two under-floor holds which have volumes of 800 cu ft forward (28ft 6in long, 4ft wide and 4ft 3in high) and 610 cu ft aft (24ft 9in long, 4ft wide and 4ft 3in high) are in any case strong enough to support a general loading of 150 lb/sq ft and a localized loading of 200 lb/sq in.

This then, is the Vanguard's carrying potential as a freighter; a payload of 40,000 lb (the DC-6A carries about half this amount) and a total capacity of 7,130 cu ft which is subject to the normal design pressurization dP of 6.5 lb/sq in—an essential feature where many and varied loads (including livestock) may be carried.

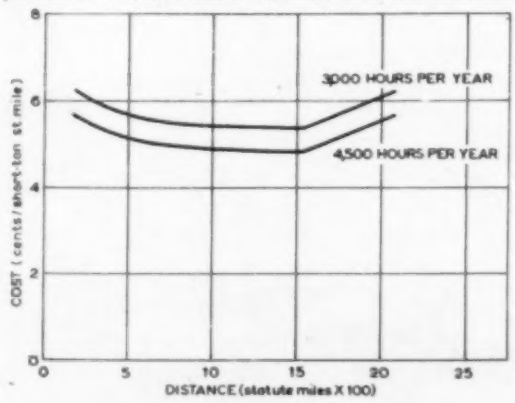
In the comparative weight break-downs opposite, the empty-weight reduction achieved—from 70,685 lb to 66,000 lb—is very largely the result of abandoning the relatively bulky equipment and soundproofing that the airliner requires to carry up to 115 passengers in comfort; the passenger seats, seat-belts and tables alone among the many other items listed as "furnishings" account for 2,800 lb of the empty weight of the Vanguard. In the Freighter version, the empty weight total quoted takes account of the increased weight entailed by the necessary structural modifications and also includes 154 lb for the total oil capacity of the four engines and an allowance of 250 lb for fuel which is assumed to be unusable.

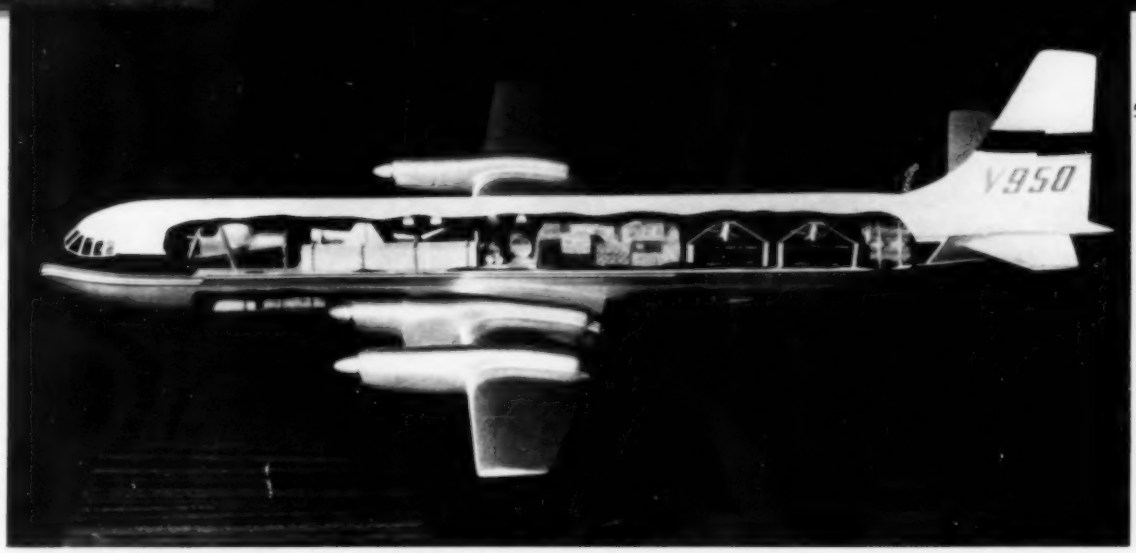
Advantage has been taken in preparing the weight summary (an American market has been assumed) of certain concessions made by an American special Civil Air Regulation concerning *Trial Operation of Transport-category Aircraft in Cargo Service at Increased Zero Fuel and Landing Weights* which, in brief, waives some of the structural provisions contained in C.A.R. 4b and permits the operation of aircraft on cargo duties at weights in excess of those allowed in passenger service. The zero fuel weight, for example, may be increased by up to 5 per cent and this increase, in pounds, may also be applied to the structural landing weight. Application of this concession to the Vanguard Freighter project allows an increase in the maximum landing weight up to 113,700 lb and increases the zero fuel weight from 98,500 lb to 103,700 lb.

Normally a reduction in V_{no} is entailed if the zero fuel weight is raised, but in the Vanguard Freighter design analysis Vickers think it likely that this weight can be raised to 106,700 lb with little or no alteration to the normal limiting speed. At 106,700 lb Z.F.W. a maximum payload of 40,000 lb (plus 7,000 lb of reserve fuel) can be carried and the limiting-payload factor is then the modified maximum structural landing weight.



Weight allowances included in the estimated payload-distance curve are 270 lb pre-flight fuel, 260 lb take-off and landing fuel, 250 lb unusable fuel, 510 lb for three crew and 190 lb for food and crew baggage. In constructing the cost-distance estimate U.S. domestic operations are assumed. Both curves assume I.S.A. and zero headwind.





Cargo represented in this part-sectioned model—exhibited at Farnborough—includes a helicopter in the forward part of the hold.

TABLE I: AIRLINER AND AIR FREIGHTER WEIGHTS COMPARED

	Vanguard Freighter lb	Vanguard lb
Weight empty	66,000	70,685
Operating weight empty	66,700†	74,668*
Maximum payload	40,000	21,000
Zero fuel weight	106,700	98,500
Reserve fuel	7,000	5,500
Maximum landing weight	113,700	108,500
Maximum take-off weight	135,000	135,000

* Includes crew and baggage, oil, residual fuel, disposable galley, de-icing and toilet fluids, water, life-belts, dinghies and oxygen.
† Includes crew and baggage, food, drinking water and flight equipment.

A more detailed analysis of the airframe than has been considered desirable—or necessary—at this stage would be required to access whether 40,000 lb represents the peak payload of the existing structural design.

A reconsideration of the structure or some comparatively minor structural revision may make it possible to overcome the landing weight limitation; dotted lines on the payload-distance curve show the estimated capabilities with an assumed payload of 50,000 lb. In this case, however, the greater zero fuel weight would entail a structural limitation on V_{no}.

In a general analysis of this type, consideration of the specific operating techniques that would be used on particular routes must, to a certain extent, be sacrified to an analysis based upon inter-state operations within the United States with costs determined by a slightly modified form of the *Lockheed Method for the Estimation of Direct Operating Costs of Aircraft SLR/1200*. Although the maximum fuel economy of the Vanguard is achieved by operating at about 30,000ft, a cruising altitude of 22,000ft has been chosen, since for a constant engine speed flying at this reduced height will result in an increased cruising speed, and the comparatively small penalty in fuel consumption is offset by a reduced flight time. Operating technique is: cruise at 13,500 r.p.m. at a constant altitude; climb at 13,500 r.p.m. and 170 kt E.A.S.; and descend at 11,500 r.p.m. and 220 kt E.A.S. while taking 3,000 shaft horsepower from each engine.

The economics of air freight are unaffected by the unknowns of passenger appeal that may mean so much to an airlines' load-factors, and with cargo rates scheduled to be standardized in October this year (at an I.A.T.A. conference in Paris), the competitive features of a turboprop freighter are likely to be the economy, block speed and reliability that result from good design and steady development. Vickers have been able to assume that the standard engine-overhaul life of the Tynes will be 1,000 hr and the total estimated operating costs per aircraft statute mile have been reduced by 2½ per cent from the Lockheed method, because the overhaul and maintenance costs resulting from the reduced vibration of the turboprop are assumed from experience to be lower. The striking reduction of 25 per cent has been made in the aircraft maintenance costs for this reason. No allowance has, however, been made for the use of the equipped airframe weight in the Lockheed method—the removal of the passenger cabin equipment is not reflected in the analysis.

Consideration of costs for an American market does have to include, however, the U.S. import tax on first costs—this stands at 14½ per cent at the present time, but is likely to be reduced on a sliding scale to 12½ per cent in 1958. Operation of the Tyne engines may be either on kerosine or wide-cut gasoline; in the cost analysis 270 lb aviation kerosine at 12 cents per gallon is assumed for pre-flight fuel used, 150 lb for take-off and 110 lb for landing. Further assumptions include an estimate of depreciation to 10 per cent of the residual value after seven years; an insurance premium of five per cent of the cost of the complete aircraft per annum, and provision for engine spares holdings amounting to 75 per cent of the cost of four engines, and airframe and airscrew spares at 10 per cent of the cost of the complete aircraft less engines. Oil consumption is expected to have a negligible effect upon running costs.

TABLE II: SUMMARY OF OPERATING COSTS

Stage distance (st. miles)	*250	500	1,000	1,500	2,000
Block fuel (lb)	3,680	6,990	13,300	19,750	26,100
Block time (minutes)	45	83	155	229	302
Block speed (m.p.h.)	334	360	387	393	398
Payload (lb)	40,000	40,000	40,000	40,000	34,930
(short tons)	20	20	20	20	17.4
3,000 Hours Utilization					
Fuel and oil cost ($/hour)	95.00	93.60	93.90	94.70	93.70
Insurance cost ($/hour)	39.74	39.76	39.79	39.79	39.79
Crew cost (3 crew members) ($/hour)	47.80	49.30	50.10	50.50	50.60
Total flying operations cost ($/hour)	182.54	182.66	183.79	184.99	184.09
Estimated fixed cost ($/hour)	240.89	240.89	240.89	240.89	240.89
Total Hourly Cost $	423.43	423.55	424.68	425.88	424.98
Cost per aircraft statute mile (cents)	126.8	111.7	109.5	108.5	106.5
Cost per short-ton statute mile (cents)	6.1	5.6	5.5	5.4	6.1
4,500 Hours Utilization					
Total Hourly Cost $	372.03	371.93	373.07	374.07	373.39
Cost per aircraft statute mile (cents)	111.5	103.0	96.5	95.2	94.0
Cost per short-ton statue mile (cents)	5.5	5.1	4.9	4.7	5.4

* At 20,000ft altitude

Declaration of these assumptions enables the cost summary table to be viewed in perspective. The Vanguard Freighter project considers a large aircraft that has a remarkable payload capacity combined with high block speeds. At an annual—and not impossible—utilization of 4,500 hr it would have a work potential of 34,650,000 short-ton miles per year with a payload of 40,000 lb, and if landing weight limitation can be overcome and the payload increased to 50,000 lb, the annual work capacity would be 42,312,500 short-ton miles per year. This payload is comparable to that of the Douglas Globemaster, the largest of the U.S. transports in service.

Aircraft of this capacity demand plenty of work to be available if they are to be used at attractive frequencies on short stages. Although air freight business has steadily increased in the past two years, it is not expanding at anything like the rate of passenger transport. That it will eventually do so (and follow the pattern of other forms of transport) is a widely held belief; the capacity and operating economy of the freighter version of the Vanguard may well give it the necessary incentive.

"So I says to this Vickers bloke, 'I was on Guards-vans before you was born.'"

FAREWELL

PICTURES BY

THE 1956 Central Flying School Meteor 7 Aerob
has now disbanded. Though we may only imagi
final flight together, the picture below at least en
parable thrill of formation aerobatics. Secured fr
is probably the most breath-catching of its kind
study of particular appeal, in this case by reason
is a third "Adams piece," which yields its full
machine is noted—and this may not be instantly
lower left are the pilots of the team: (left to righ
(No. 2); F/L. M. B. Kemp (No. 3); and F/L. J.
that, immediately after the flight here recorded,
duties at Boscombe Down. Of the Meteor 7 M
am sure all the boys there [at C.F.S.] will have the
Of the C.F.S. team he says, "It has always been
work and enthusiasm is an inspiration to us

ERFORMANCE

BY USSELL ADAMS

Team recently flew together for the last time, and he feelings experienced by the four pilots on their s us to share with them something of the incom- the rear seat of the "box" aircraft, this photograph printed. The "swan" formation (left) is another s composition and light and shade. On the right ard only when the attitude of the team leader's arent because of the perfect station-keeping. At /L. D. G. T. Franklin (leader); F/O. P. B. Hine McArthur (No. 4). We hear from Russell Adams . Franklin left Little Rissington to take up new iams writes: "It has been a grand old lady and I piest memories of its docile flying characteristics." reat delight to fly with these grand fellows, whose Sentiments that will find ready endorsement.

A Sopwith 1½-Strutter in American service.

HISTORIC MILITARY AIRCRAFT: No. 14

PART II

By J. M. BRUCE, M.A.

THE SOPWITH 1½-STRUTTER

IN those anxious weeks preceding the Battle of the Somme the need for fighting aircraft in France was so great that No. 70 Sqn., R.F.C., went overseas by Flights as soon as aircraft became available. The 1½-Strutter had been put into production for the R.F.C. early in 1916; the first contractors were Ruston, Proctor and Co., Ltd., of Lincoln, and the first deliveries were made to No. 70 Sqn. On May 24, 1916, "A" Flight went to France; but "B" Flight did not cross the Channel until June 29 and did not reach its base at Fienvillers until July 3. On July 30 "C" Flight arrived in France.

This third Flight of No. 70 Sqn. was equipped with ex-R.N.A.S. 1½-Strutters. As such they were armed in accordance with Admiralty practice, which meant that their gun-synchronizing gears were of the Scarff-Dibovski type. Lt-Cdr. V. V. Dibovski, an officer of the Imperial Russian Navy, had brought his ideas on machine-gun synchronizing to the notice of the R.N.A.S. in January 1916. These ideas were quickly developed and realized by Warrant Officer F. W. Scarff, a gunner on the staff of the Air Department of the Admiralty.

If all reports are true, there can be little doubt that the 1½-Strutter was fitted with a greater variety of machine-gun synchronizing and interrupter gears than any other aircraft used by the British aerial forces during the war. It seems tolerably certain that the machines built for the R.N.A.S. had the Scarff-Dibovski gear as standard equipment. Other types of synchronizing gear, however, were fitted to the 1½-Strutters delivered against War Office contracts.

According to the official history*, the first 1½-Strutters delivered to the R.F.C. were fitted with the Vickers-Challenger gear, and the machines of "A" and "B" Flights of No. 70 Sqn. were so equipped. The same authority states that the 1½-Strutters of No. 45 Sqn. R.F.C. (which arrived at Fienvillers from England on October 15, 1916) had the Scarff-Dibovski gear, but according to Capt. Norman Macmillan, who served with No. 45 Sqn., the unit's early machines were fitted with the Ross interrupter gear. The latter gear was evolved by F/Sgt. Ross, an N.C.O. serving with the R.F.C. in France, and it was a true interrupter gear. As such it slowed down the gun's rate of fire to a marked degree. When the Ross gear was fitted, the Vickers gun retained its normal ground trigger; in real emergencies, when a high rate of fire was demanded, pilots used that trigger and risked damaging their own airscrews. Captain Macmillan has recorded that he knew of no case of airscrew disintegration resulting from this rather desperate action.

There can be no doubt that the Ross gear was fitted to some 1½-Strutters, for Maurice Baring recorded on May 8, 1917: "Van Ryneveld now is commanding No. 45 Squadron, which fly Sopwith two-seaters. He has only one Ross interrupter gear." One is tempted to wonder whether the machines delivered to No. 45 Sqn. may have had the Scarff-Dibovski gear at the time of delivery, only to be re-equipped with the Ross gear at an early stage in their service. Unless the Admiralty actually sought to reclaim the Scarff-Dibovski mechanisms from the Sopwiths, thereby necessitating the change, it hardly seems likely that such a modification would be made purely for its own sake at a time when synchronizing gears of any kind were scarce and the aircraft were so urgently needed at the front.

A little later, the Sopwith company produced its own gun-synchronizing gear. This was the Sopwith-Kauper gear, which has been described as a development or improvement of the Ross gear. There may have been a similarity in the physical appearance and even in the functioning of the two gears, but the Sopwith-Kauper mechanism was a synchronizing device which positively fired the gun instead of interrupting its fire as the Ross gear did. Considerable numbers of 1½-Strutters were fitted with the Sopwith-Kauper synchronizing gear.

In matters of armament the 1½-Strutter pioneered not only gun-synchronizing gears for fixed armament but also (and equally importantly) a new type of mounting for the observer's free gun on the rear cockpit. Once again a fine piece of equipment which was rapidly standardized originated from the R.N.A.S., for the outstandingly practical gun-mounting had been designed by W/O. Scarff, the same Scarff who had been responsible for developing the Scarff-Dibovski synchronizing gear.

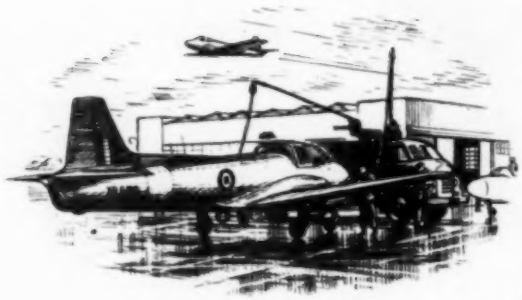
Scarff's first ring-type mounting for a free Lewis gun, known as the Scarff No. 1 ring mounting, was not adopted for general use, but it was an ingenious device and an enormous advance over all earlier mountings. Not only did it provide the gunner with a means of moving his gun quickly but it incorporated a gun-sight which automatically allowed for "own" and "enemy" speeds and gave the gunner the correct allowance for deflection (or, in the jargon of a later war, angle off). Facilities for training in the use of the Scarff No. 1 mounting could not be provided; consequently it had to be abandoned.

It was followed by the Scarff No. 2 ring mounting, and it was this device which was fitted to the 1½-Strutters ordered by the Admiralty. The gun was carried on a U-shaped bridge of steel tube, mounted centrally and flexibly at the mid-point of the base of the U. The ends of the legs of the U were hinged to a metal ring, and the U-member could be elevated from the horizontal through a considerable arc. At about the mid-points of the legs of the U, quadrantal guides were fitted; these guides had one rack-toothed edge, the teeth being engaged by pins in the legs of the U-member. The pins could be retracted by the operation of a lever (somewhat similar to the brake-lever of a motor cycle) mounted on the cross-piece of the U near the gun; and when the pins were disengaged the U-member could be elevated and lowered. This vertical movement was made against rubber cord in tension. The ring to which the U-member was attached rolled freely about a fixed ring: it could rotate through 360 deg but was locked and unlocked at any point by the same lever which controlled the elevation of the U-shaped bridge. The fixed ring was rigidly attached to the fuselage.

Thus a gunner could swing his gun in elevation and azimuth. He stood with his left hand on the locking lever, his right holding the Lewis gun, and a target could be followed instantly and

* *"The War in the Air," Vol. II, page 163.*

In Service with the Royal Air Force



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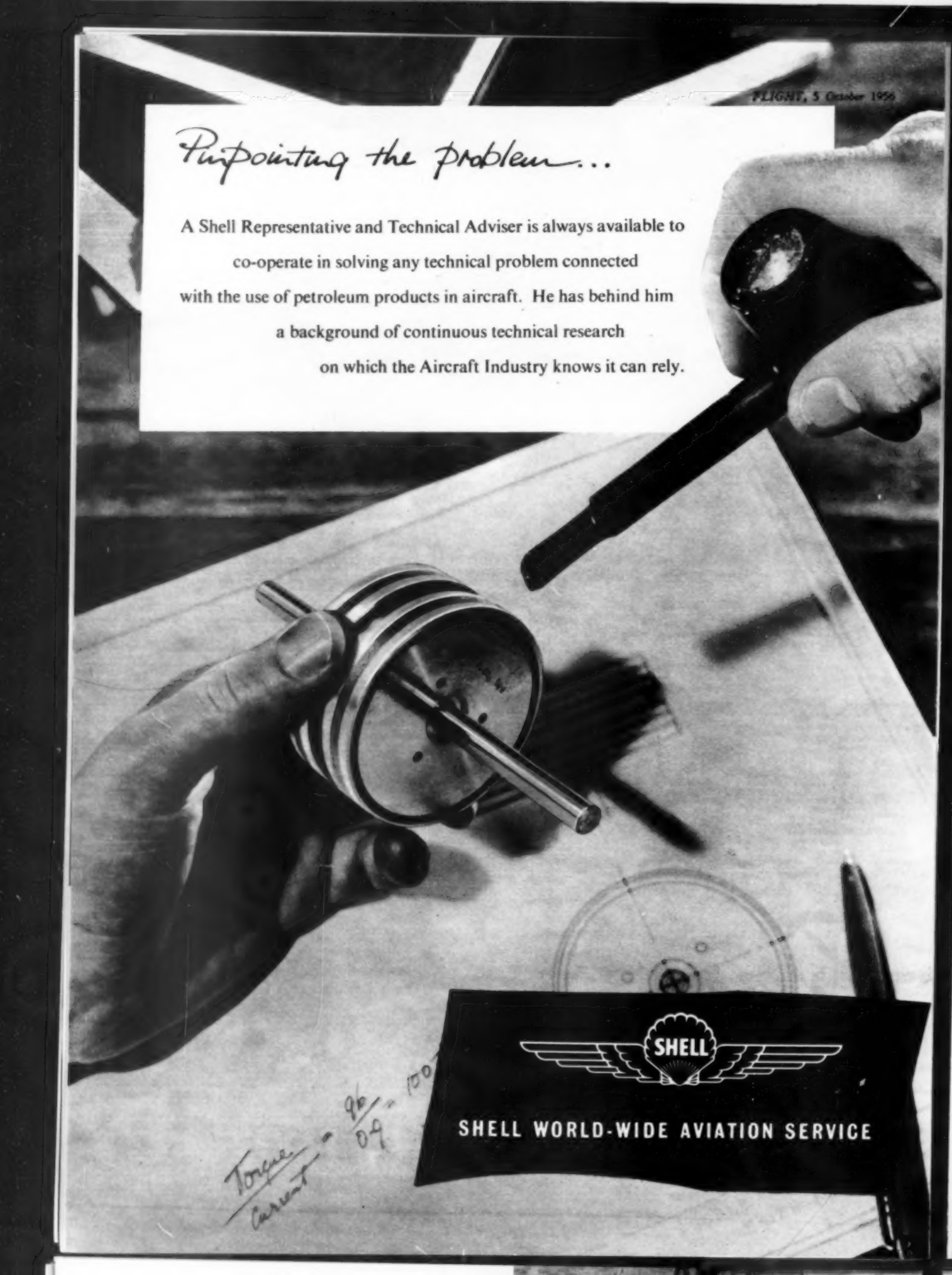

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THE SOPWITH 1½-STRUTTER . . .

instinctively merely by clutching the lever and swinging the gun round with complete freedom. Once the firing position was reached, locking was instantaneous when the lever was released, and the gunner then had both hands available for shooting.

The Scarff No. 2 mounting was a brilliant addition to the Allies' armoury. It was an immediate success, and was ultimately standardized throughout the British flying services and in those of many of the Allies. It remained in service with the R.A.F. almost up to the outbreak of the Second World War.

The first Scarff mountings in the R.F.C. were those which were fitted to the ex-R.N.A.S. 1½-Strutters of "C" Flight of No. 70 Sqn. History does not seem to have recorded the nature of the observers' gun-mountings of the R.F.C.-type machines of "A" and "B" Flights of the squadron, but they would almost certainly be of the Nieuport type. This mounting, of French design, was the type which was installed in the Nieuport XII two-seater. It permitted traversing and elevation of the gun, but was crude by comparison with the Scarff mounting. Some 1½-Strutters of the first batch built by Ruston, Proctor and Co. had the Nieuport mounting.

The excellence of the Scarff device was immediately apparent, and General Trenchard lost no time in requesting that it be fitted to all Sopwith 1½-Strutters supplied to the R.F.C. Production of the mountings increased and all later aircraft were equipped with the device.

A few of the earlier R.N.A.S. 1½-Strutters were fitted with a simple cranked pillar in the rear cockpit for the observer's gun. This mounting allowed only limited traversing and elevation, and must have been uncomfortable in use.

No. 70's Sopwiths were in action during July 1916, acting as escorts to the Martinsydes of No. 27 Sqn. and performing long-distance reconnaissances. Both duties brought them many fights, for the aircraft were required to penetrate far into enemy territory. The 1½-Strutter's considerable endurance led naturally to its employment on such duties and to its association with the Martinsyde, which was also a long-range aircraft. The two squadrons, Nos. 70 and 27, shared Fienvillers Aerodrome, and together they brought the war to the enemy in such distant places as Valenciennes, Solesmes, Le Cateau and Bohain.

The pilots and observers of No. 70 Sqn. soon displayed a fighting spirit second to none, and the Sopwith 1½-Strutter set a glorious example for its doughty successor, the Bristol Fighter. At 6.45 p.m. on August 6, 1916, an evening patrol of No. 70 Sqn., led by Capt. W. D. S. Sanday, met a formation of ten German bombing aircraft near Bapaume; the enemy bomb racks were full, and they were westward-bound for targets in Allied territory. The 1½-Strutters promptly attacked, fought all ten German machines back to their own aerodrome, and compelled them to land with all their bombs still aboard.

On August 24 a burning wad from an anti-aircraft shell struck the 1½-Strutter flown by 2nd Lt. A. M. Vaucour and 2nd Lt. A. J. Bott of No. 70 Sqn. The fuselage caught fire, but Bott ripped away the canvas round the burning area and beat out the flames with his hands. The aircraft continued its patrol. It was involved in a fight with two enemy machines and the petrol feed pipe to the engine was shot through. Vaucour managed to glide back to the Allied side of the lines and landed south of Carnoy. But the 1½-Strutter's adventures were not over. Next day, A/M.1. H. P. Warminger repaired the damage and was being flown back to Fienvillers in the observer's cockpit when the aircraft was attacked by three enemy machines. During the combat the Sopwith was struck by splinters from an anti-aircraft shell. The engine stopped and Warminger sustained wounds from which he died that evening, but Vaucour again accomplished a successful forced landing.

At that time the Sopwiths were able to fly in small numbers and give a good account of themselves in combat. On September 6, 1916, three of No. 70's 1½-Strutters were making a reconnaissance of Cambrai and Busigny when they were attacked by enemy aircraft. Capt. Sanday shot one down in flames and the remainder were driven off. Near Bapaume an offensive patrol from the same squadron attacked four German machines and shot one down. Capt. G. L. Cruikshank (who had gone to France with No. 3 Sqn. in August 1914) shot down another which ran into the parapet of a trench near Flers; later, Cruikshank attacked three Roland biplanes single-handed and forced one down.

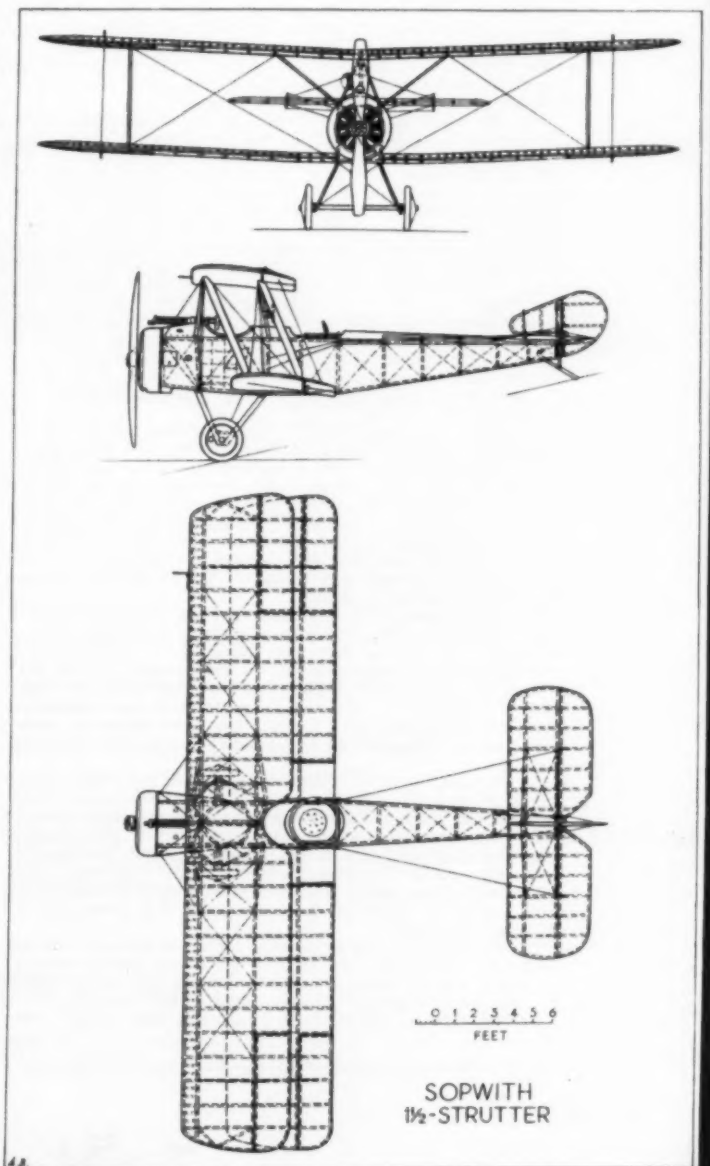
This gallant officer was shot down and killed on September 15, the day of the commencement of the third phase of the Battle of the Somme. He was leading an early morning patrol, seven strong, and when over Havrincourt Wood he saw a German fighter below him. He dived to the attack without hesitation and fought brilliantly, but his chosen opponent was Oswald Boelcke, who was probably flying one of the new Albatros D.Is, and the 1½-Strutter was no match for the nimble single-seater. Boelcke's formation split up the other Sopwiths, forced one down with its fuel tank shot through and its observer mortally wounded, and badly damaged two others, which reached the Allied lines with dying observers. Enemy losses consisted of three driven down, of which one was seen to crash, and two machines which collided as they attacked the 1½-Strutters.

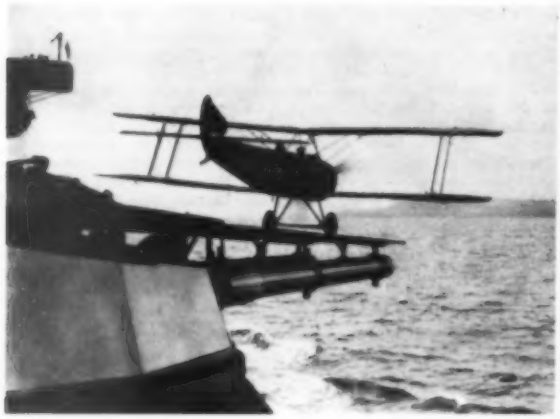
It might almost be said that this fight marked the beginning of the end for the Sopwith 1½-Strutter. On August 30, 1916, *Jagdstaffel 2* had been formed at Lagnicourt under Boelcke, and the first of their new Albatros D.Is arrived on September 3. The Albatros was of clean design, was fast and manœuvrable, and was armed with twin synchronized machine-guns. The *Jagdstaffel* also had some Halberstadt scouts, which were also a match for the 1½-Strutters.

The Boelcke *Staffel* began organized operations on Sunday, September 17, 1916, and at once inflicted such losses upon the R.F.C. units opposing them that on September 30 Sir Douglas Haig wrote to the War Office, drawing attention to

> "the urgent necessity for a very early increase in the numbers and efficiency of the fighting aeroplanes at my disposal . . . we shall undoubtedly lose our superiority in the air if I am not provided at an early date with improved means of retaining it . . . the enemy has brought into action on the Somme front a considerable number of fighting aeroplanes which are faster, handier, and capable of attaining a greater height than any at my disposal with the exception of one squadron of single-seater Nieuports, one of F.E. Ro[l]ls-Royce [F.E.2d], and one of Sopwiths [1½-Strutters]—the last mentioned being inferior to the enemy's new machines in some respects though superior in others."

It has been observed that the War Office was slow to order the 1½-Strutter for the R.F.C., and even the aircraft transferred from Admiralty contracts do not seem to have been sufficient to permit the formation of another squadron for many weeks. Pro-





(Left) 1½-Strutter taking off from a ship's gun turret. (Right) laying the sections of a gun-turret take-off platform for a shipboard 1½-Strutter. Note the external control locks on the aircraft.

THE SOPWITH 1½-STRUTTER . . .

duction difficulties further delayed deliveries and, by a coincidence, it was not until September 30, 1916, that the second 1½-Strutter squadron of the R.F.C. received its full complement of twelve aircraft. The unit was No. 45 Sqn., and it did not reach Fienvillers until October 15. One week later, three of its Sopwiths failed to return from an offensive patrol.

Only one other R.F.C. squadron, No. 43, was equipped with 1½-Strutters. It did not arrive in France until January 17, 1917, by which time the Sopwiths were outclassed. In the autumn of 1916 the 1½-Strutter's 110 h.p. Clerget was replaced by the 130 h.p. engine of the same make. The more powerful engine was standardized; with it the aircraft's rate of climb was improved, but there was little worthwhile improvement in terms of level speed.

In March 1917, No. 70 Sqn. suffered heavy losses. The enemy had withdrawn to the Hindenburg Line in the middle of the month, and the R.F.C.'s Ninth Wing was required to make long reconnaissances to seek out new defence systems east of that line and to watch for indications of further withdrawals. At that time it was desired to restrict the use of the new D.H.4s and Bristol Fighters until the opening of the Arras offensive: that excluded No. 55 Sqn. from the reconnaissance work, which then fell upon the F.E.2Ds of No. 57 Sqn. and the Sopwith 1½-Strutters of No. 70 Sqn.

On March 24, six of No. 70's Sopwiths were attacked by a superior force of enemy fighters while on the way to Valenciennes. Two 1½-Strutters were shot down and the battle-scarred remainder got back only with difficulty. Next morning another six machines set out for the same objective; this time only one survived, and that because its defective engine obliged the pilot to turn back over Cambrai. All five others were lost. The Valenciennes reconnaissance had always been a hazardous mission, and on those two March days it deprived No. 70 Sqn. of fourteen of its officers and seven aircraft.

The 1½-Strutters of Nos. 43 and 70 Sqns. played their part in the Battles of Arras, mostly in performing long-range reconnaissances, but by then they were usually given strong escorts of single-seaters. Ground-strafing was not a normal duty for the 1½-Strutter, but on May 3, 1917, five machines of No. 43 Sqn. attacked enemy troops massing in the trenches for a counter-attack on the British XIII Corps. The same squadron made similar attacks on bodies of enemy troops during the afternoon of the 3rd.

On the following day the Sopwiths of No. 70 Sqn. fought with a flash of their old fire when nine of them, unescorted, were attacked over Tournai by several groups of enemy single-seaters. The 1½-Strutters were in the act of taking their photographs when the enemy fighters struck. Some successful photographs were taken, but the Sopwiths had to fight all the way home. One was forced to land with a holed fuel tank; another brought back a dead observer. Three of the enemy were sent down, one of them out of control.

The three 1½-Strutter squadrons carried on gallantly during the Battle of Messines. No. 43 Sqn. again went ground-strafing on June 7, two days after No. 45 had suffered heavy losses while attempting a photographic reconnaissance near Menin.

By that time the end of their tribulations was in sight: re-equipment with Camels was intended, No. 70 by July 31, No. 45 by August 15, and No. 43 by August 31. Only No. 70 Sqn. was re-equipped on schedule, however; by August 15 No. 45 had received only eight Camels, and did not complete its complement until September 1; and the last of No. 43's Camels did not arrive until October 3. So the Battles of Ypres began with Nos. 43 and 45 Sqns. still flying to war in 1½-Strutters. No. 43 did excellent work on August 15, 1917, flying from an advanced landing ground. Eighteen sorties, all flown at less than 1,000ft, were mounted; 5,000 rounds of ammunition were fired, chiefly at ground targets; much information was passed to Corps H.Q. and artillery; an enemy two-seater was shot down and a single-seater was forced down out of control. The squadron lost two 1½-Strutters, and two pilots and one observer were wounded.

The re-equipment of Nos. 43 and 45 was delayed because Gothas bombed London in daylight on June 13 and July 7, 1917. In order to strengthen Home Defence units, No. 46 (Pup) Sqn. was withdrawn from France on July 10, and on the 13th Maj-Gen. Trenchard was told by the War Office that twenty-four Camels which had been destined to re-equip one of the 1½-Strutter squadrons were to be diverted to Home Defence squadrons.

The 1½-Strutter was itself used on Home Defence duties on a modest scale. Fifty-six two-seaters and three single-seaters were delivered to Home Defence units, and were used by Squadrons Nos. 37 and 44. The latter unit began to form at Hainault Farm on July 24, 1917, but did not keep its 1½-Strutters for long. Re-equipment with Camels began in August and was completed in the following month. On July 7 one of No. 37 Squadron's 1½-Strutters, manned by Lt. J. E. R. Young and A/M. C. C. Taylor, was among the heterogeneous collection of 95 R.F.C. and R.N.A.S. aircraft which rose in a haphazard swarm to attack the

A 1½-Strutter with skid undercarriage taking off from H.M.S. "Vindex."

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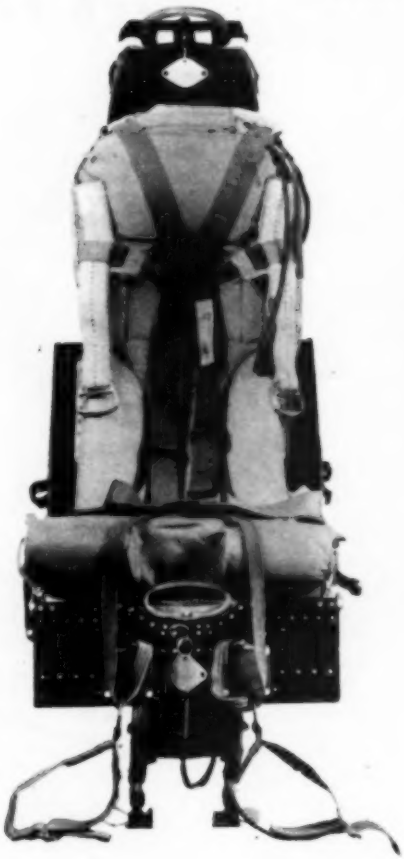

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ENGLAND —— CANADA

THE SOPWITH 1½-STRUTTER . . .

21 Gothas which had bombed London by daylight. The Sopwith was one of the 36 defenders which succeeded in closing with the raiders, but it was shot down: Young was killed and his observer wounded.

For Home Defence purposes, particularly anti-airship duties, at least one 1½-Strutter was modified in unusual fashion. The aircraft was B.762, a rebuild made by No. 1 (Southern) Aeroplane Repair Depot. It was a single-seater, flown from what was normally the rear cockpit, and was armed with a pair of Lewis guns which were mounted in a near-vertical position just in front of the cockpit and fired upwards behind the upper wing [a photograph appeared in Part I of this article, p. 546, September 28]. It is not known whether B.762 left No. 1 A.R.D. in that form, however: it may have been modified by the unit to which it was allocated. Nor is it known whether the machine was unique.

A standard single-seat version of the 1½-Strutter existed and was built in considerable numbers. It was a bomber, with an internal bomb bay immediately behind the rear cabane struts: there were cells for twelve small bombs. The pilot's seat in the 1½-Strutter bomber was in the normal place under the upper wing, and the single Vickers gun was retained. Some of the bombers used by the R.N.A.S. Fifth Wing had a Lewis gun mounted centrally above the upper wing. In that position it was quite inaccessible to the pilot and could not be reloaded in flight.

The single-seat bomber version of the 1½-Strutter was used in considerable numbers by the R.N.A.S., forming part of the equipment of the Third and Fifth Wings. A few were also used in Macedonia. Several of the Admiralty contracts apparently called for a mixture of single-seaters and two-seaters; and the R.F.C. received 89 1½-Strutter single-seat bombers. It seems remarkable that no records of single-seaters in service with the R.F.C. have survived. It seems fairly certain that none were used operationally in France by that Service: some may have been used as trainers or as personal transports; some may have gone straight to store as a source of spares; some may have been converted into two-seaters. Official statistics show that 72 went to training units, 13 to the Middle East, three to Home Defence stations, and one to the Expeditionary Force in France.

Outside France the 1½-Strutter in British service was used operationally only by the R.N.A.S. Mixed units operated from islands in the Aegean: "A" Sqn. was based on Thasos, "B" at Thermi on Mitylene, and "C" at Gliki on Imbros and Mudros on Lemnos. At Stavros on the mainland a fourth unit, known as "D" Sqn., was based. All had some 1½-Strutters and all were active, particularly against enemy communications.

In February 1917 a German squadron, *Kampfgeschwader 1*, arrived at Hudova aerodrome. It had come from Bucharest, whence its twin-engined A.E.G.s and Friedrichshafens and single-engined Rumplers had conducted a bombing campaign against Roumania. This powerful force made its presence felt, for its aircraft were up-to-date and superior to most of the British aircraft available in Macedonia. Lt-Gen. G. F. Milne, who was in command of the British forces in Macedonia, saw in *Kampfgeschwader 1* a serious threat to the success of a projected attack to be made by the XII Corps on the western shore of Lake Dojran. He wrote to Vice-Admiral Sir Cecil F. Thursby, commanding the Eastern Mediterranean Squadron, and asked if R.N.A.S. aircraft might be made available to augment the R.F.C.

In response to this request the vice-admiral provided two units, which were formed by taking aircraft and crews from the four existing R.N.A.S. squadrons in the Aegean. The first new unit, designated "E" Sqn., was formed in March 1917 with four 1½-Strutters and one Sopwith Triplane. It went to Hadzi Junas, where it joined forces with three B.E.12s of No. 17 Sqn., R.F.C., and a B.E.12 and two D.H.2s of No. 47 Sqn., to form the Composite Fighting Squadron. "F" Sqn. was formed as a bombing squadron and had an assortment of 1½-Strutters of both fighter and bomber versions. The unit went to Amberkoj on April 29, 1917, commanded by Sqn. Cdr. J. R. W. Smyth-Pigott, and proceeded to exact retribution for the bombing of *Kampfgeschwader 1*. The 1½-Strutters bombed dumps and camps behind the Dojran front, sometimes twice daily.

On May 10, a raid on Hudova revealed that the enemy bombing squadron was no longer there. On the following day "F" Sqn. flew to Marian to initiate a bombing campaign on the Struma front. Railway stations, ammunition dumps and Drama aerodrome were attacked, and on May 25 a dump at Livunovo was destroyed.

On May 27 the squadron lost five of its aircraft in an accidental explosion in the hangars at Marian. This so reduced "F" that it was amalgamated with "E" to form a new "F" Sqn. which was re-equipped at Mudros. On June 6, 1917, the revivified "F" was sent to Thasos to assist "A" in incendiary raids on enemy crops. After eleven days "F" Sqn. was withdrawn to Mudros to make diversionary attacks designed to distract enemy attention from the activities of the R.N.A.S.'s solitary Handley Page 0/100. At the end of July the unit went to Thermi for special bombing duties in the Smyrna area. Its equipment consisted of five 1½-Strutter bombers, three 1½-Strutter fighters and a single Camel. From August 1 until September 17, "F" Sqn. conducted a vigorous and successful bombing offensive, flying a total of 13,000 miles in the process.

The R.N.A.S. used 1½-Strutters as shipboard aircraft, principally from aircraft carriers. In January 1918 the Operations Committee of the Board of Admiralty laid down the policy that reconnaissance aircraft should, in the main, be employed from carrier vessels and that fighting aircraft should be carried in fighting ships. This same committee had recommended in October 1917 that the carrier *Furious* should be fitted with a landing-on deck abaft the superstructure. In March 1918 the ship rejoined the Grand Fleet after structural alterations which had given her a landing deck 284ft long and 70ft wide. Her complement of aircraft then consisted of fourteen two-seat 1½-Strutters and two Sopwith Pups, but later varied considerably. The carriers *Vindex* and *Argus* also had 1½-Strutters in their equipment.

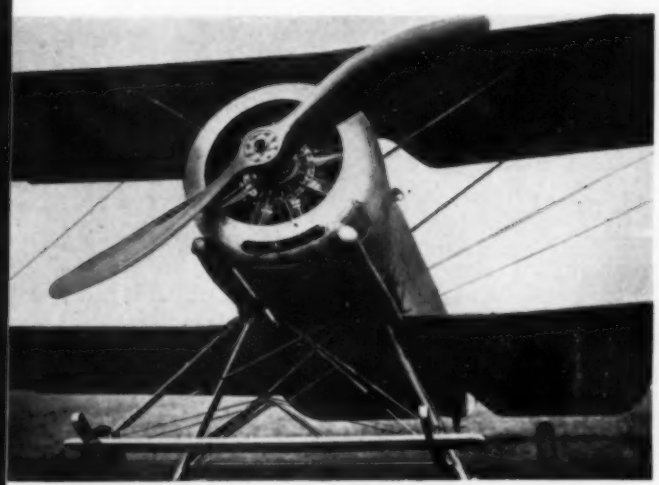
Some at least of the carrier-borne 1½-Strutters had rigid skid undercarriages generally similar to those which were fitted to the Sopwith 9901a version of the Pup (see *Flight*, January 1, 1954). Doubtless these undercarriages were evolved from the experience obtained with the Sopwith 9901a in service. Some 1½-Strutters were also fitted with the Grain flotation gear, and ditching trials were successfully conducted. An inflatable air-bag was fitted to each lower longeron behind the engine, and at least one aircraft had a hydrovane attached to the forward ends of the undercarriage skids, presumably to prevent nosing-over on striking the water.

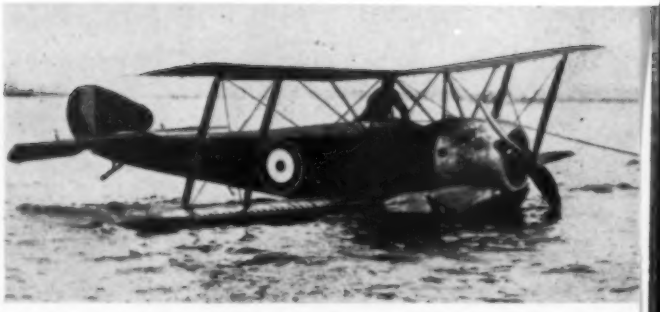
A 1½-Strutter with a skid undercarriage was flown from H.M.S. *Vindex* in a manner which recalled Cdr. Samson's disastrous first attempt to fly a Camel from a lighter towed by a destroyer (see *Flight*, April 29, 1955, p. 561). The aircraft concerned was N.5601, and its skids ran in special grooves on the flying deck.

The histories of the Sopwith Pup and Camel have told something of the development of the bold technique of flying single-seat fighters from tiny platforms built on to the turrets of capital ships. So successful was this practice that it was decided to attempt similar flights with two-seat reconnaissance aircraft. The type selected for the trials was the 1½-Strutter; the ship was the battle cruiser *Repulse*. The turret platform on *Repulse* was extended, and the first take-off was attempted in March 1918. For unexplained reasons that attempt failed.

The platform may have been too short, for the experiments were transferred to the Australian battle cruiser H.M.A.S. *Australia*, on which a bigger platform was built. From that ship the first successful take-off was made on April 4, 1918: the 1½-Strutter was piloted by Capt. F. M. Fox and carried an observer and full wireless equipment. This success led to the decision to fit extended platforms for two-seat aircraft to the forward turrets of all battle cruisers; single-seat fighters were to be carried on after turrets. At the end of October 1918 thirty-six two-seat 1½-Strutters were with the Grand Fleet, and the type is known

1½-Strutter with skid undercarriage, hydrovane and stowed Grain flotation gear.





Westland-built 1½-Strutter afloat with Grain flotation gear inflated.

THE SOPWITH 1½-STRUTTER . . .

to have been used on the battle cruisers *Queen Elizabeth* and *Barham* in addition to *Australia*.

Other 1½-Strutters had made oversea patrols long before the type was used from shipboard. Germany began her campaign of unrestricted submarine warfare on February 1, 1917, at the same time changing from surface gun-fire attacks to submerged attacks with torpedoes. Thirty-five ships were sunk in the English Channel and the Western Approaches during the first week of February 1917, and the attacks were intensified in the following month. Existing seaplane patrols were inadequate, and no additional seaplanes could be provided to augment those already in service. In April, therefore, three new aerodromes were opened, at Pembroke, Mullion and Prawle Point; and the initial equipment of each station consisted of four 1½-Strutters. These units were short-lived, however, for the necessity of maintaining the strength of R.N.A.S. units attached to the R.F.C. in France led to a shortage of pilots; consequently the anti-submarine 1½-Strutter units had to be disbanded in August 1917.

In the Mediterranean, 1½-Strutters based at Otranto were used for anti-submarine duties, chiefly as stand-by aircraft which could be sent up immediately a U-boat sighting was reported. On September 17, 1917, a 1½-Strutter from Otranto dropped a 65-lb delayed action bomb just ahead of a U-boat a few seconds after it had dived. The explosion brought a large patch of oil to the surface.

The 1½-Strutter was still in service with the R.A.F. at the time of the Armistice. Of the few which survived until then, only those attached to the Grand Fleet and possibly those in the Mediterranean could be regarded as being on an operational footing.

If the War Office had been slow to acknowledge the worth of the 1½-Strutter our French allies were not. Nine of the first 150 machines built for the Admiralty were transferred to France, and three of them bombed Essen with success. More R.N.A.S. machines, including several of the single-seat bomber version, were later transferred to France. The type was produced in France under licence and, if contemporary reports are correct, production was on a vast scale, for it has been said that 4,500 were built by French firms. Many had the 110 h.p. Le Rhône engine as an alternative to the Clerget. In the service of our ally the 1½-Strutter was designated in French style: the two-seat reconnaissance version was known as the Sopwith 1A.2, the two-seat bomber was the Sopwith 1B.2, and the single-seat bomber the Sopwith B.1 (which should not be confused with the later single-seat bomber, powered by the 200 h.p. Hispano-Suiza engine, which had the Sopwith type number B.1). All versions saw extensive use with French units on the Western Front, and a number were used in Macedonia. After its withdrawal from operational use in the *escadrilles* the 1½-Strutter was widely used as a trainer in France. Many of the machines were powered by the 80 h.p. Le Rhône and were fitted with full dual control. Several French-built 1½-Strutters survived the Armistice and went on to the French civil register.

It seems probable that France supplied 1½-Strutters to Russia and Belgium. A few British machines were given to each country: Russia received N.5219 and N.5244; and eight two-seaters, N.5235-N.5242, were transferred to Belgium. It is known that the 1½-Strutters flown by Russia had both Le Rhône and Clerget engines, a fact which seems to confirm French manufacture. The Russians used their Sopwiths as reconnaissance aircraft in 1917, and in the post-revolution fighting the White Russians used several.

Three squadrons of the Belgian Flying Corps were equipped with 1½-Strutters. One of these units was the 4th Squadron, and one of the pilots of that squadron was First-Class Sergeant Willy Coppens (later Major le Chevalier Willy Coppens de Houthulst), who was to become Belgium's leading fighter pilot. He first flew a 1½-Strutter on April 29, 1917, and recorded in his book, *Days on the Wing*, an impression of the aircraft which hints at the reason for the fitting of air-brakes:—

> "The machine glided marvellously, and the only difficulty was to land on the spot selected: pilots, accustomed to come down steeply on aeroplanes that were not such good gliders, found the Sopwith to attain so great a speed that they were unable to pull up within the limits of the aerodrome. I thus saw Orta, who had been given the first Sopwith acquired by the Belgian Flying Service—for the law of seniority held good even at the front—foozle his landing and carry on across the road that ran alongside the aerodrome, to the great alarm of the sentry, on duty at that point, who threw himself face down on the cobbled highway. After passing over the sentry, Orta did his best to get the engine to pick up again, but it choked, and the wretched Sopwith went on to finish up in a field, so violently that our first One-and-a-Half Strutter was reduced to matchwood; and great was the pity."

Coppens later says:

> ". . . and the Sopwith, in spite of all its good points [was] rather slow in manœuvring. . . . I dared not put my Sopwith into too steep a dive, and was therefore forced to go down in a broad spiral. Even so, at the speed the machine thus gathered, the wires screamed and the controls became terribly stiff. Assuredly the Sopwith two-seater was no fighter aeroplane!"

At that time, Coppens' 1½-Strutter had no forward gun fitted. He was therefore at a disadvantage when attacked by four German single-seaters on May 1, and was lucky to escape with 32 bullet-holes in his aircraft.

When King Albert of the Belgians visited the 4th Squadron on July 6, 1917, he expressed a desire to fly in one of the unit's Sopwiths. He was taken over the lines by Jacques de Meeûs.

The American Expeditionary Force bought 514 1½-Strutters from France in February and May of 1918. The majority of these machines were used as trainers at the A.E.F. training aerodrome at Issoudun, but some were allocated to the U.S. 90th Aero Squadron, which flew these ageing warriors operationally for a time.

Small numbers of 1½-Strutters went to other countries. Some were sent to Roumania before the end of the war, and the type was also used by Japan. A few were used by Latvia in the 1919 fighting against the Bolsheviks.

Today, only one example of this fine aeroplane is known to survive. Of the thousands which were built in Britain and France none now remain in their countries of origin, for the last survivor of the species is in Brussels, in the Musée Royal de l'Armée et d'Histoire Militaire. There, bearing the Belgian number S.88, rests the last of the first great fighting Sopwiths.

SPECIFICATION AND SUMMARY

Powerplant.—110 h.p. Clerget 9Z; 130 h.p. Clerget 9Bc; 135 h.p. Clerget 9Ba; 110 h.p. Le Rhône 9J; 130 h.p. Le Rhône 9Jby; 80 h.p. Le Rhône 9C.

Dimensions.—Span, 33ft 6in; length, 25ft 3in; height, 10ft 3in; chord, 5ft 6in; gap, 5ft 4½in; stagger, 2ft; dihedral, 2 deg 23 min; incidence, 2 deg 10 min; tailplane span, 13ft 6in; wing area, 346 sq ft.

Manufacturers.—Sopwith Aviation Co., Ltd., Canbury Park Road, Kingston-on-Thames.

Other Contractors.—Fairey Aviation Co., Ltd., Hayes, Middlesex; Hooper and Co., Ltd., 77 Kings Road, Chelsea, London, S.W.; Mann, Egerton and Co., Ltd., Prince of Wales Road, Norwich; Morgan and Co., Leighton Buzzard; Ruston, Proctor and Co., Lincoln; Vickers, Ltd. (Aviation Department), Imperial Court, Basil Street, Knightsbridge; Wells Aviation Co., Ltd., 30 Whitehead's Grove, Chelsea; Westland Aircraft Works, Yeovil. *France:* F. Lioré et Olivier, Rue de Villers 46, Levallois-Perret; and doubtless other French manufacturers.

Production and Allocation.—The precise total number of Sopwith 1½-Strutters built is not known. Serial numbers show that over 1,500 were ordered from British contractors for the R.F.C. and R.N.A.S. Additional British-built 1½-Strutters may have been delivered to France and Russia, and it has been said that 4,500 were built by French manufacturers.

According to official statistics, 607 two-seat 1½-Strutters and 89 examples of the bomber version were delivered to the R.F.C.; these figures included 77 aircraft transferred from the R.N.A.S. R.F.C. Squadrons in France received 346 two-seaters and one single-seater; 13 single-seaters were sent to the Middle East Brigade; 56 two-seaters and three single-seaters went to Home Defence squadrons; and 205 two-seaters and 72 single-seaters were delivered to training units. Of the 1½-Strutters built for the R.N.A.S., apart from those transferred to the R.F.C., 61 were transferred to France, eight to Belgium and two to Russia.

On October 31, 1918, the R.A.F. had 171 1½-Strutters on charge. They were located thus:—

	Two-seaters	Single-seaters
With the Grand Fleet	36	2
With the 5th Group	3	1
Egypt	-	3
Mediterranean area	11	2
At various aerodromes in the U.K. ...	58	10
At Aeroplane Repair Depots	11	-
In store	18	16

In February and May, 1918, the American Expeditionary Force purchased 514 Sopwith 1½-Strutters from the French Government. Some examples of the aircraft were also supplied to Roumania and Japan.

Costs.—Airframe without engine, instruments or armament: £842 6s; Engines: 130 h.p. Clerget, £907 10s; 110 h.p. Le Rhône, £771 10s.

Armament.—One fixed Vickers machine-gun mounted centrally on top of the fuselage in front of the pilot's cockpit; this gun was fired forward through the airscrew by means of the Vickers-Challenger,

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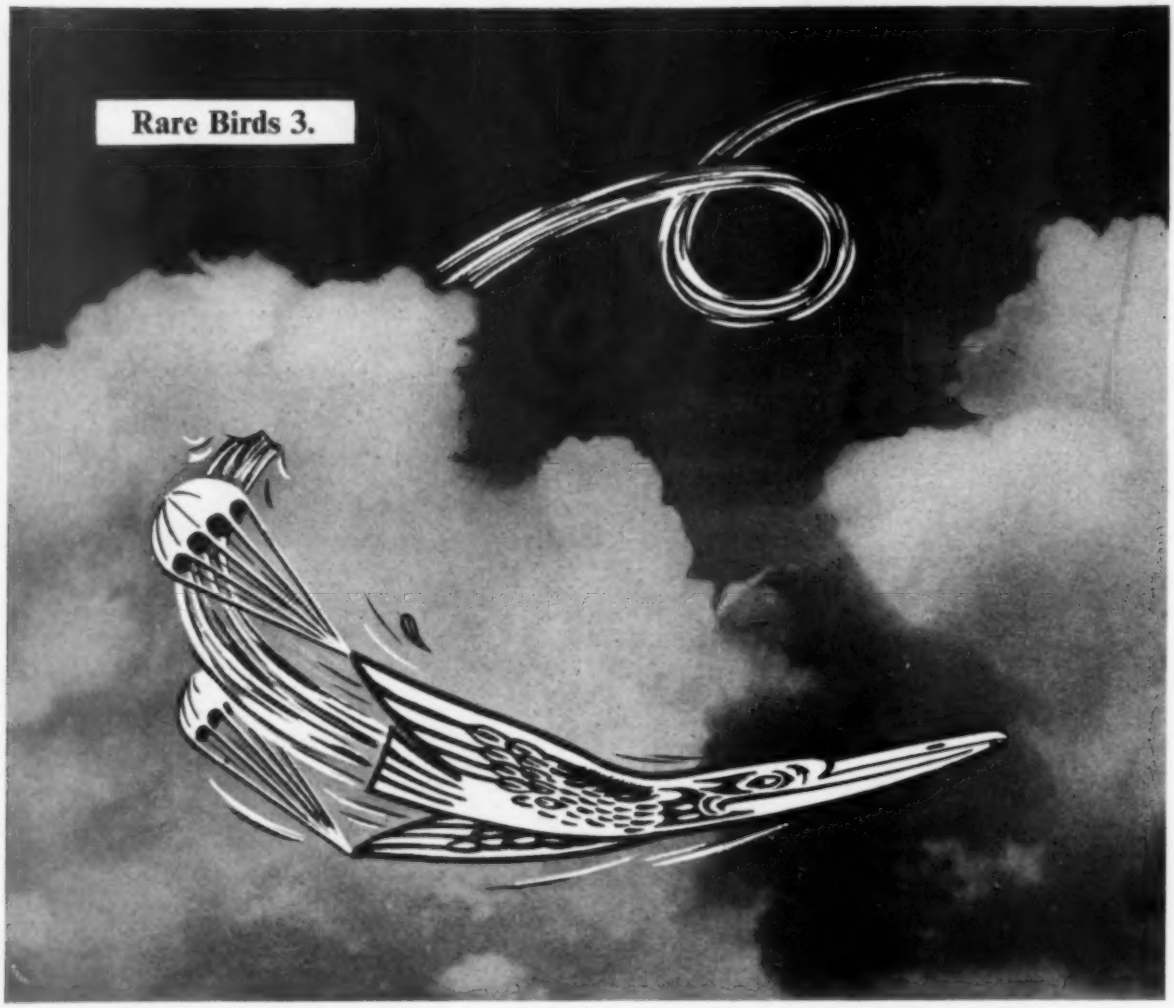

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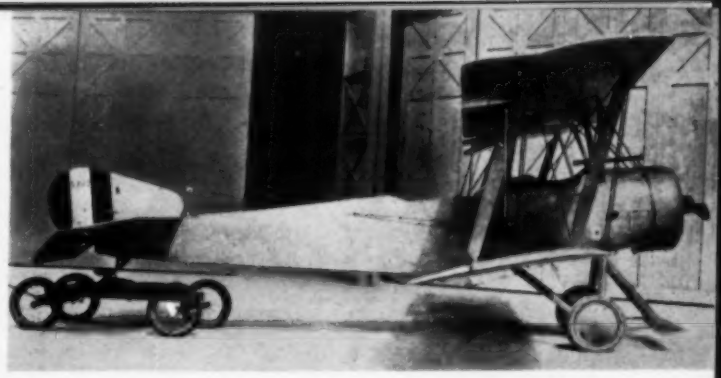


American 1½-Strutter with hydrovane fitted in front of undercarriage.

THE SOPWITH 1½-STRUTTER . . .

Scarff-Dibovski or Sopwith-Kauper synchronizing gear, or by the Ross interrupter gear. The two-seat version had a single free Lewis gun on a pillar-type mounting, Nieuport ring-mounting, or Scarff No. 2 ring-mounting on the rear cockpit; the bomb load could consist of twelve le Pecq or two 65-lb bombs. The single-seat bomber version occasionally had a forward-firing Lewis gun mounted centrally above the upper wing in addition to the standard Vickers gun; the bomb load consisted of four 56-lb bombs or an equivalent weight of other bombs. At least one Home Defence single-seat 1½-Strutter had a pair of Lewis guns mounted in a near-vertical attitude to fire upwards immediately behind the trailing edge of the upper wing.

Service Use.—*Western Front:* R.F.C. Sqns. Nos. 43, 45 and 70; R.N.A.S. Sqns. Nos. 5 and 8; R.N.A.S. Third Wing; French *Escadrilles* Nos. 29, 54, 210 and others; Belgian Flying Corps Sqns. Nos. 2, 3 and 4; United States Air Service 90th Aero Sqn. *Eastern Front:* Flown by some Russian units. *Macedonia:* R.N.A.S. Sqns. A, B, C, D, E and F, and as part of the Composite Fighting Sqn. at Hadzi Junas; also used by a French unit based at Florina. *Home Defence:* R.F.C. Sqns. Nos. 37 and 44. *Coastal Patrol:* R.N.A.S. stations at Great Yarmouth, Mullion, Pembroke and Prawle Point. *Shipboard use:* Aircraft carriers *Furious*, *Vindex* and *Argus*; battle cruisers *Barham*, *Queen Elizabeth*, and H.M.A.S. *Australia*, *Mediterranean:* R.N.A.S. station Otranto. *Training:* Training squadrons at Eastbourne, Shawbury and Wyton; R.N.A.S. stations at Cranwell, Dover and Manston; American Expeditionary Force 3rd Instruction Centre, Issoudun.

Serial Numbers.—*1½ Strutters originally ordered for the R.N.A.S.:* 3686, two-seat prototype built by Sopwith; 9376-9425, two-seat fighters built by Sopwith, sixteen transferred to R.F.C.; 9651-9750, sixty-five two-seaters and thirty-five single-seaters built by Sopwith, 41 transferred to R.F.C.; 9892-9897, A.878-A.897 and A.1902-A.1931, all built by Sopwith; N.5080-N.5179, built by Sopwith, mostly single-seat bombers; N.5200-N.5249, built by Mann, Egerton (the first twenty were single-seat bombers); N.5500-N.5549, single-seat bombers ordered from Sopwith (only 38 were built); N.5550-N.5559, built by Sopwith; N.5600-N.5624, five single-seat bombers and twenty two-seaters built by Westland; N.5630-N.5654, two-seat fighters built by Mann, Egerton.

Delivered to the R.F.C.—7762-7811, two-seat fighters built by Ruston Proctor; A.377-A.386, built by Sopwith; A.954-A.1053, built by Fairey; A.1054-A.1153, two-seaters built by Vickers; A.1511-A.1560, built by Westland; A.2381-A.2430, built by Ruston Proctor; A.2983-A.2991, built by Sopwith; A.5238-A.5337, two-seaters built by Wells; A.5950-A.6149, built by Morgan (some were single-seaters); A.6901-A.7000, built by Hooper; A.8141-A.8340, built by Ruston Proctor; A.8744-A.8793, two-seaters built by Vickers; B.2551-B.2600, built by Ruston Proctor.

Notes on Individual machines.—*Used by No. 5 Sqn, R.N.A.S.:* 9378, 9383, 9396, 9397, N.5514, N.5531. *Used by No. 43 Sqn, R.F.C.:* A.960, A.961, A.970, A.1010, A.1100 ("C.5"), A.1108 (shot down by Manfred von Richthofen), A.2388, A.2401. *Used by No. 45 Sqn, R.F.C.:* 7774, 7775, 7792 ("Little 'Erbert," flown by Lt F. T. Courtney), 7800, A.1075, A.1077, A.1083, A.1084, A.1095, A.2381, A.2382, A.2385, A.8260, B.2576, B.2583. *Used by No. 70 Sqn, R.F.C.:* 7763, A.380, A.884, A.954, A.956, A.957, A.958, A.976, A.981, A.994, A.995, A.996, A.997, A.1002, A.1069, A.1514, A.1902, A.1925, A.2983, A.2984, A.2986, A.8172, A.8213.

Other machines: 9378, "New Zealand No. 1"; 9383, "Britons in Japan No. 1"; 9395, "Tientsin Britons No. 1"; 9401, "Poverty Bay, New Zealand No. 2"; 9405, "Britons in Egypt No. 1"; 9410, used by No. 3 Wing, R.N.A.S.; 9420, interned in Holland, 17.9.16; 9422, used at R.N.A.S. station Dover; 9423, "Peking Britons No. 1"; 9654, "Rio de Janeiro Britons No. 1"; 9667, "Tientsin Britons No. 2"; 9669, used by No. 3 Wing, R.N.A.S.

9722, "Sao Paulo Britons No. 1", used by No. 3 Wing, R.N.A.S.; 9739, "Britons in Egypt No. 2"; 9742, bomber used by No. 3 Wing, R.N.A.S.; 9744, "Britons in Italy No. 1". A.6006: used in H.M.S. *Queen Elizabeth*; A.6987, fitted with skid undercarriage, modified wing bracing and Grain flotation gear; B.762, single-seat conversion for Home Defence duties with twin upward-firing Lewis guns (flown from rear cockpit); B.2591, flown at Eastbourne; N.5084, "Sao Paulo Britons No. 2"; N.5086, R.N.A.S. Mudros.

N.5089, N.5091, N.5098, N.5107, N.5115, N.5116, N.5171, N.5173 and N.5174, all used by No. 3 Wing, R.N.A.S.; N.5119, used by "F" Sqn, R.N.A.S., Stavros; N.5219, transferred to Russia; N.5224, used by No. 2 Wing, R.N.A.S., Mudros; N.5235-N.5242, transferred to Belgium; N.5244, transferred to Russia; N.5503, R.N.A.S. Dover; N.5512, used by No. 3 Wing, R.N.A.S.; N.5517 and N.5527, used by the R.N.A.S. at Mudros. N.5601, used in H.M.S. *Vindex*; N.5630 and N.5632, flown at Cranwell.

WEIGHTS AND PERFORMANCE

Version	Two-seater		Single-seater	
Clerget engine h.p.	110	130	110	130
Weight empty (lb)	1,259	1,305	1,354	1,316
Military load (lb)	520	517	500	524
Fuel and oil (lb)	370	328	508	502
Weight loaded (lb)	2,149	2,150	2,362	2,342
Max. speed (m.p.h.) at:				
6,500ft.	100.5	100	—	102
10,000ft	96.5	97.5	94	98.5
Climb (min and sec) to:				
6,500ft	10 50	9 10	14 00	12 40
10,000ft	20 25	17 50	26 55	24 35
Service ceiling (ft)	—	15,500	12,500	13,000

Note.—The two-seater had a flight endurance of 4¼ hr with the 110 h.p. Clerget and 3¾ hr with the 130 h.p. engine.

Photographs of World War I aircraft en masse are seldom seen. This striking picture shows 1½-Strutters of an American training unit. The majority of the aircraft have retained their original French camouflage markings, but a few are marked with American roundels.

THE INDUSTRY

D.H. Propellers Directorship

SECRETARY of de Havilland Propellers, Ltd., since April 1952, Mr. A. S. Wheate, C.A., has been appointed a director. After war service as an armoured-vehicle officer he qualified as a chartered accountant, and joined the de Havilland Aircraft Co., Ltd., in September 1947. His first eighteen months were spent in the business, personnel and production departments, studying organization and methods; and this period included four months at Chester, where he assisted in taking over control from Vickers-Armstrongs, Ltd., of the Broughton factory, which today handles the major share of D.H. aircraft production. In March 1949 he became assistant to the secretary of de Havilland Aircraft, and three years later was appointed secretary of de Havilland Propellers, Ltd.

Westland Aircraft, Ltd., have announced three new appointments—those of (left to right) Captain H. A. Traill, C.B.E., R.N. (rtd.), who becomes service manager; Mr. L. Thornhill, A.F.R.Ae.S., who has joined the company as assistant to the sales manager; and Mr. W. W. Hinks, who has been appointed technical sales engineer.

A new company under the title of Aeroservices Engineering, Ltd., precision engineers, has been registered. An associate of Aeroservices, Ltd., they have registered offices at Croydon airport, Surrey, and their works are at East Hoathly, Sussex. The first directors are Messrs. J. Lester Pendleton and E. F. M. Wright.

* * *

Mr. A. S. Bishop, managing director of the Goodyear Tyre and Rubber Co., Ltd., recently completed 40 years' service with the company. To mark the occasion he received a gold and diamond service pin at a presentation performed by Sir William Elliott, G.C.V.O., K.C.B., K.B.E., D.F.C., a Goodyear director.

* * *

British Oxygen announce that a new private company, British Oxygen Research and Development, Ltd., has been registered; it came into existence on October 1. Members of the Board are: Dr. P. H. Sykes (chairman), Dr. N. Booth (managing director), and Dr. L. C. Bannister. The secretary is Mr. J. W. Coates.

Appointed to the Board of de Havilland Propellers, Ltd., as recorded in a paragraph above, is Mr. A. S. Wheate (left). Also announced by the company is the appointment of Mr. J. E. Blazeby, chief draughtsman since 1947, as assistant engineering manager (guided weapons).

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Blackbushe in Action

AS a personal observer of the air traffic movements at Blackbushe during the Farnborough Show period, I would like to endorse the remarks made by H. Joyce in your September 21 issue, and at the same time try to present a picture of the movements during that period, which is now an annual event.

Owing to this year's weather conditions, the visitors to Blackbushe were less than half the previous year's figure, but this did not lessen the work of the control-tower staff. In fact on the Wednesday the work was made more difficult by the I.F.R. conditions which prevailed for most of the day.

By 0700Z the board was full of inbound visiting aircraft, all from foreign bases, and all on airways clearances. The types consisted of such aircraft as Nord 2501, S.O.30P, Belgian C-119s, and Canberras and Vampires from 2nd T.A.F. in Germany. By 0830Z there was a holding stack of aircraft orbiting Blackbushe up to about 10,000 ft, as each had to be brought in on G.C.A.

At this time the U.K. traffic had started to wend its way towards Blackbushe and unfortunately could not be accepted owing to the weather conditions, although several did maintain V.F.R. underneath a very low ceiling and made it. Approximately one hundred R.A.F. aircraft were diverted to such places as Odiham, Benson or back to departure point.

The story on the Tuesday was slightly different, and for this day a few personal figures are available. The movements during this one day totalled to 262 and the airfield had 98 visiting aircraft, both military and civil, of 41 different types from seven different nations. These aircraft included several light types with no radio.

At no time were delays in departures and arrivals experienced and the normal schedule of the resident airline companies was carried out without a hitch. A helicopter service with an S-55 was also operated to and from South Bank, plus a shuttle service with a Sycamore to and from Farnborough. Blackbushe was also one of the diversion airfields which, along with Odiham, stood by in case of an emergency at the S.B.A.C. Show itself.

Under the leadership of the S.A.T.C.O., Mr. Hicks, the control tower staff work as a team at this airfield, which is one of the busiest in the country, providing a 24-hour service to all and sundry which is a credit to all concerned. Perhaps one day we shall see an official appreciation, which I personally think is long overdue.

Bovingdon, Herts. NATIVE SON.

Naming the D.H.110

I NOTICE that as yet the D.H.110 remains nameless. My own opinion is that it would be most fitting if it was called after that very fine pilot, John Derry, who gave his life in the development of this aircraft. If it was called the de Havilland Derry, this would be in keeping with the practice of using alliteration in the naming of aircraft.

Glasgow. HONOUR DUE.

Confirmation Corner

ON September 26 at about 11 o'clock I believe I saw a B-47 heading in a S.S.W. direction; it was very high and I only saw it through a small gap in the clouds. Please did anyone also see this aircraft? I wish to put it in my spotting books.

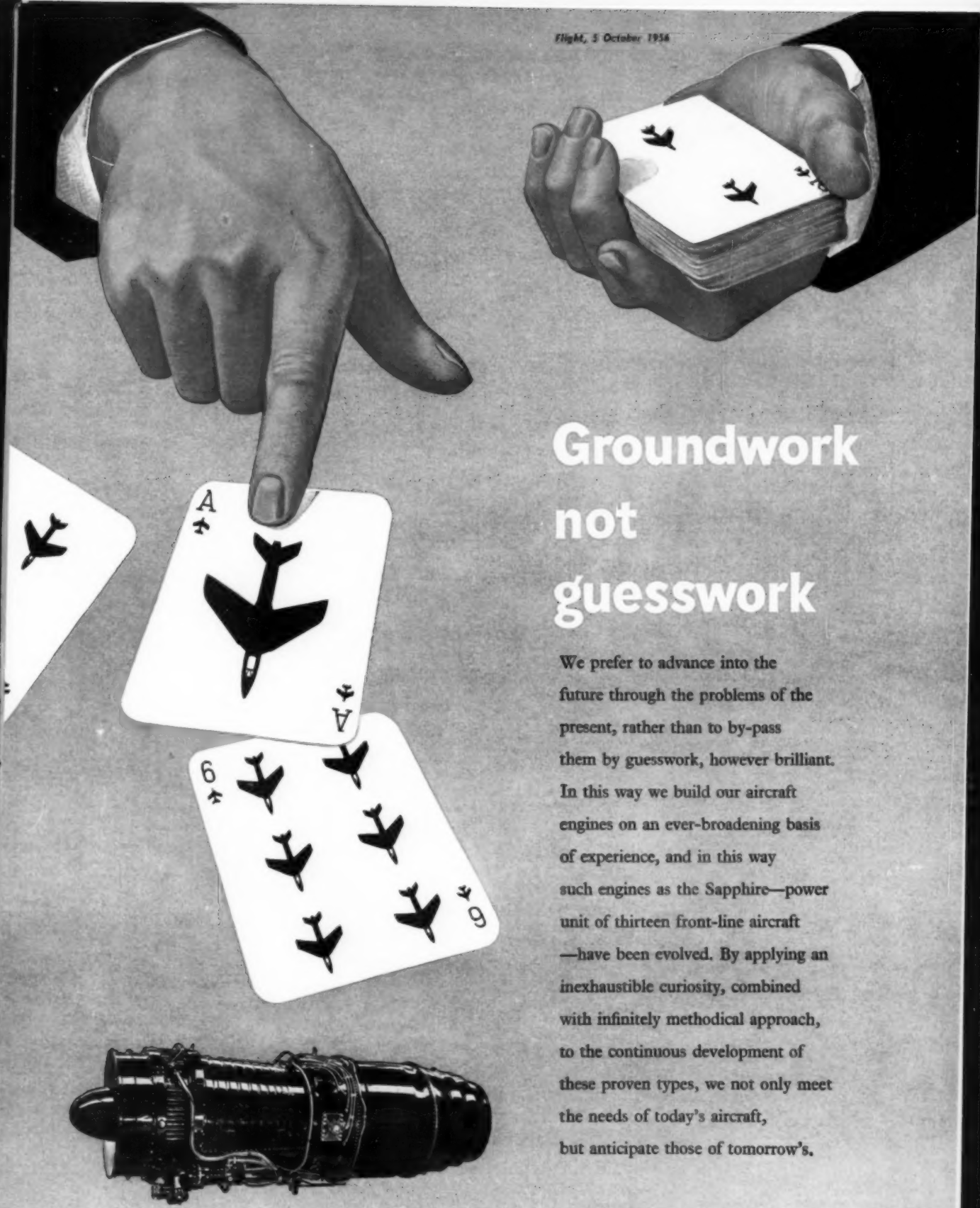
London, N.10. M. BLANCHARD (age 13).

LETTERS IN BRIEF

Referring to the cross-section of the "6 per cent" Gnat wing illustrated on p. 517 of our issue of September 21, Mr. R. K. Page, chief technician (projects) of Folland Aircraft, Ltd., writes to say that the use of the tie-rods—or "posts" as they are usually called in the works—is based on an N.A.C.A. concept (ref. N.A.C.A. *Technical Note* 3118) by which some of the intermediate webs in a multi-cell wing are deleted in favour of ties or posts. Their function is similar to that of the spars in stabilizing the compression skin by connecting it to the inherently stable tension skin, though they are not required to transmit a continuous shear flow, which is dealt with by the remaining spar webs. In certain sizes of wing, of which this is one, an appreciable weight-saving can be obtained by this form of construction. Mr. Page adds that the screwed ends of the rods (which are riveted-over on the outside) are merely a convenient way of fixing them to the skins and stringers.

* * *

Mr. P. C. Sen, of 54 Replingham Road, London, S.W.18, is seeking information on the following matters and would be grateful for facts: (1) The cost of training of civil and military pilots during the years 1914, 1939, 1945 and 1956. (2) Taking 1914 as the base year and the price index as 100, the comparative rise in the cost of training and the price index. (3) The comparative speeds (approximate) of the military transport and bomber aircraft and civil transports during the above-mentioned years.



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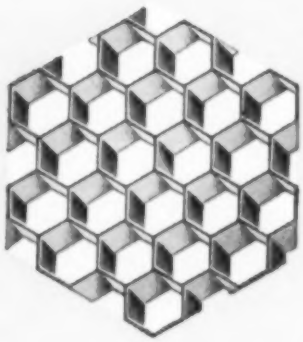

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Venue Southampton

Aerodrome Owners in Conference and on Tour

OVER a hundred members of the Aerodrome Owners' Association met at Southampton on Thursday and Friday last week for their annual conference, and into those two days packed a swift but comprehensive inspection of the ancient port's modern facilities and of some of the airfields which now exist in its vicinity.

Only a small part of the delegates' time was taken up with the traditional conference fare of speech-making and discussion, when on the first afternoon Captain J. W. G. James, B.E.A. Flight Operations and Communications Director, gave a concise paper on "Future Helicopter Sites in the U.K."

Capt. James set out with academic clarity the basic problems of helicopter operation, both from the airline and the municipal points of view; but it was clear from remarks which followed (particularly those made by Mr. C. M. Newton, of Sywell) that delegates were more anxious to know just when—and to where—helicopter services were likely to become a practical possibility. It seemed a pity that this discussion had to be curtailed when it had hardly more than started; but so close was the time schedule (and maintained with an airline accuracy), that the delegates were soon on their way to the Ocean Terminal to witness an older and much slower form of transport, in the graceful shape of the *Queen Mary* sailing at 4 o'clock precisely on that Thursday afternoon for New York.

This visit to Southampton's docks—showpiece of a city which has been sending vessels to sea long before Henry V embarked there for Harfleur—was naturally a highlight of the conference. No one with a spark of imagination can fail to be impressed by ships; no less could one fail to be impressed by the vision and courage and energy of Sir Herbert Ashcombe Walker's enterprise in creating Southampton's vast and thriving new dock area out of land once owned by the sea, where Canute is said to have had earlier (but much less profitable) ideas about driving back the waters.

It was interesting to compare the city's splendid harbour facilities with those offered in the surrounding countryside for air passengers, with whom the Aerodrome Owners are concerned in their own localities. On the first morning of the conference, delegates went by motor coach to Hurn, and on the second day visited Eastleigh and Hamble.

At both Hurn and Eastleigh they were welcomed by Mr. C. M. Colbeck, Divisional Controller for the Ministry of Civil Aviation, representing the Minister. Mr. Colbeck in both instances outlined briefly the history, present facilities and administration of the airfield, describing the problems of upkeep and how the cost of this was met, at any rate in part, by tenants ranging from manufacturers like Vickers-Armstrongs or Saunders-Roe to (in the case of Hurn) small "one-man" businesses.

At Hurn, most of the visit was taken up with a tour of the Vickers Viscount assembly lines, on which approximately the last third of the Capital order for 745s was being completed. The delegates, escorted in groups by helpful guides, saw how swiftly the handsome aircraft grew in a hangar's length from separate wing, fuselage and engine section to the finished product in Capital markings. Of special interest to the visitors was the modification introduced by the American company of folding passenger steps lowering from and retracting into a door forward of the wing section. This enables Capital to do a very quick turn-round on short-haul trips between comparatively adjacent cities. (A turn-round time of two minutes has been reported from the U.S.)

Alderman Mrs. P. M. Hyde, Mayor-elect of Coventry and a delegate to the conference, airborne in a Hiller with S/L. George Webb, the C.F.I., during the visit to A.S.T.

The visit to Hurn lasted only an hour and ten minutes, which included Mr. Colbeck's short talk and some refreshments, so that following the tour of Vickers' assembly lines it was time to leave for Southampton where a luncheon had been arranged in the Civic Centre at the invitation of the Mayor and Corporation. So as far as inspecting the aerodrome facilities was concerned, there was no time to do more than peer through the windows of the coaches as they moved slowly by the airport buildings towards the main Bournemouth-Southampton road.

The second and last day of the conference agenda consisted of the visit to Eastleigh, lunch at Lyndhurst by invitation of Shell-Mex and B.P., Ltd., and finally an afternoon visit to Hamble to see something of the work done by Air Service Training, Ltd.

At Eastleigh, after Mr. Colbeck had described the airfield's facilities both verbally and visually, explaining that nearly £8,000 had been spent on improvements and that it now handled 100,000 passengers a year, delegates had the hydrant refuelling system—there is a similar installation at Shannon—shown and explained to them. Then they went to see the development section of Saunders-Roe, Ltd., helicopter division where Skeeters were being assembled. There they had the opportunity of talking to J. J. M. Jeffery, the Saunders-Roe helicopter test pilot, on the practical problems involved in manœuvring these trim and agile machines. He mentioned that some interesting enquiries and orders had been received recently from Mexico and East Africa, the latter involving a request for Skeeters so that trees could be inspected in vast areas which would take days to reach by older-fashioned means.

On the way to the Saunders-Roe hangar, the delegates' motor coaches passed behind an adjoining hangar which contains a famous relic. Unfortunately they did not see it, though the writer had an opportunity of doing so. It is the famous Supermarine S.6.B seaplane which set up a world speed record in 1931. It now looks very dusty and neglected—though time and tide can do nothing to obliterate the beauty of those pedigree lines.

At Hamble, following the luncheon at Lyndhurst, delegates were received by Air Marshal Sir Hugh Walmsley, managing director of Air Service Training, Ltd., who told them something of the establishment's history and its present activities. (They were also given reprints of the recent *Flight* article on A.S.T.)

Later, they were able to hear a broadcast of an Oxford doing a practice Q.D.M. into Eastleigh; and, divided into parties, they were taken on a short tour of the A.S.T. buildings, seeing amongst other things one or two typical classes in progress (with their striking mixture of student nationalities), the radio school and the Link trainer, and, in one of the hangars, Javelin assembly lines.

Just after five o'clock the conference officially ended, with delegates starting their return journeys to Ebbw Vale and Derby, to Coventry, (one of whose representatives was the Mayor-elect, Alderman Mrs. P. M. Hyde, a decidedly airminded first citizen). Manchester, Newcastle, Stoke and elsewhere. The majority of them were aldermen and councillors representing their airport committees. In these well-filled two days at Southampton, they no doubt from what they saw—and what they had heard from other delegates—learned something more about the problems of aerodrome ownership which should help them to solve their own.

A.O.A. delegates take a studious look at the Shell-Mex and B.P., Ltd., hydrant refuelling system at Eastleigh.

CIVIL AVIATION

Above, the first Lockheed 1649A seen being rolled out of the Burbank factory last week. This one is the first of 46 now on order for five airlines. Below, hangar doors at Santa Monica open to reveal the first of B.O.A.C.'s ten "insurance policy" DC-7Cs, due for delivery on October 13. (See page 597.) On the left is Mr. Ivor Lusty, B.O.A.C.'s representative on the U.S. west coast, and (right) Mr. J. R. McGowen, chief DC-7 project engineer.

A.W.A.'s NEW CIVIL VENTURE

NO hard figures, and very few tentative ones, were released by the Hawker Siddeley Group last week when it announced that one of its members, Armstrong Whitworth, was to undertake the design and manufacture of "a number of pressurized medium-range Freighter/Air Coach civil aircraft, also capable of military application."

What was announced, however, was that several million pounds (reported by one source as £10m) will be spent on the project. The passenger version would accommodate 66 passengers—indicating a payload of at least 13,000 lb, while range would be of the order of 2,500 st. miles. "Special attention" had been paid to take-off and landing distances. The aircraft would be designed to accommodate mixed payloads of passengers and freight, with passengers being accommodated at either end of the cabin; as a pure freighter simultaneous direct loading and unloading from lorry or truck would be catered for. The aircraft will be powered by four Rolls-Royce Darts, and a hint that two Tynes might be fitted as an alternative installation is contained in the statement that "a twin-engined version will be powered with Rolls-Royce gas turbines of higher power."

STRONG WORDS FROM K.L.M.

THE president of K.L.M., Mr. I. A. Aler, addressing the second European Aeronautical Congress on September 25, uttered strong words about unserviceability. "The airlines," he said, "are doing part of the designer's . . . job." The number of delays and the sight of stranded aircraft on nearly every airport, he said, gave him no reason to be satisfied. Engines were sold with an approved lifetime between overhauls of 1,000 to 1,400 hours but only half the engines reached this figure. The other half had to be withdrawn prematurely due to basic trouble. Aircraft structures and equipment kept on giving trouble and there was "no end" to the stream of service bulletins incorporating major modifications. By the time they were incorporated, what was left of guaranteed performance and weights?

This trend, Mr. Aler continued, should be reversed in the future.

Footnote: K.L.M. have on order eight DC-8s, nine Viscounts, 12 Electras, and two Friendships. The present fleet includes Super Constellations, DC-6Bs and Convair 340s.

PENALTIES FOR OPERATORS—

THE contention that many U.S. domestic airline schedules are unrealistic, and that there is a tendency to publish timetables which, although they show faster travel times, are seldom met in practice, is now being studied by the U.S. Civil Aeronautics Board. As a result of this study, it is likely that C.A.B. may require airlines to complete three out of every four flights on time, or change their schedules accordingly. One airline official is reported to have said of this proposal: "It is like trying to legislate against an Act of God."

The American Air Line Pilots Association, however, is likely to favour such legislation. Their view, expressed by a leading A.L.P.A. officer, is that unrealistic scheduling presents potential safety problems: "We are trying to get more speed out of 'planes that can't take the extra load." The C.A.B. proposal would probably allow a 25 per cent tolerance for mechanical delays and, presumably, the "Acts of God" mentioned by the airline official.

—AND FOR PASSENGERS

THE extent of the "no-show" problem—the failure of passengers to take-up reservations for particular flights—has become so widespread in the United States that it is currently regarded by the U.S. Air Transport Association as being second in importance only to the air traffic control problem. Late cancellations—or no cancellation at all—invariably mean reduced load factors, since airlines are unable to re-sell the seats. Another practice which operators are anxious to discourage is that of multiple reservations—the wily passenger's dodge to cover himself in case his plans should change.

A satisfactory solution (which would provide better service to the public and increase revenues for the carriers) has been exercising the ingenuity of the airlines for some years, and now a division of the A.T.A. known as the Air Traffic Conference of America has put forward a two-point plan.

Point one of the plan (which actually came into force last month) is the declaration of a "last time" by which a ticket must be purchased if the reservation is not to be cancelled. This has been set at 12.01 a.m. on the day of departure or six hours before take-off, whichever is the later. The airline agent will attempt to persuade the customer to buy his ticket at the time of reservation; but if this is not possible the prospective passenger will be informed of the time limit that has been imposed.

With characteristic enterprise, the airlines have tried to ease the ticket purchasing difficulties by including specified banks and convenient locations—such as "downtown drugstores"—among the places where tickets may be bought. (In practice, the receipt for the money deposited in the bank to the airline's account will be exchanged for a ticket at the airport.)

Point two of the plan, which provides for penalties, will be discussed by the airlines in December. Provided that 75 per cent of them agree, and that the Civil Aeronautics Board gives its approval, late cancellation charges and "no-show" penalties will be introduced in February 1957. If and when these regulations come into force, the penalty for "no show" or late cancellation can be expected to take the form of a deduction when the fare is refunded. The late-cancellation charge may be set at 10 per cent of the fare—with a minimum of one dollar and a maximum of three dollars—and the "no-show" penalty at 20 per cent of the fare for the first sector, subject to a minimum of three dollars and a maximum of twenty dollars.

This two-part plan is very similar to that operated at the moment by B.E.A. and B.O.A.C. Both corporations require reservations to be confirmed by the purchase of a ticket some hours before the take-off, and a "no-show" penalty (as required by I.A.T.A. in the conference Area 2 embracing Europe, Africa and the Middle East) is applied.

WEST GERMAN ELAND AIRLINER?

FROM the burgeoning aircraft industry of West Germany comes an announcement—by the Aviation Industry Association in Dusseldorf—that a 48-passenger, 330 m.p.h. machine powered by two Napier Elands is to be built. Contractors will be the Hamburg Aircraft Construction Company, working "in close co-operation" (probably with some sort of licence agreement) with the Spanish Construcciones Aeronauticas. The aircraft will be similar to that company's C-20 Azor (Hercules engines built by Hispano under licence), which was discussed in *Flight* for February 10. The aircraft will be designated H.B.F. C-209. Range is quoted as 1,200 miles.

No date has been mentioned for the start of production.

CABOTAGE IN GERMANY

THE German Government last week became the first in the world with its own airline to allow foreign-run services within its own borders. The exclusive rights of Lufthansa have been modified because the airline has insufficient aircraft to meet domestic demands. The airlines which are expected to take advantage of the new arrangement—which of course is only temporary—are K.L.M., Sabena, S.A.S., L.A.I. and PanAm.

NEW NORTH ATLANTIC FACILITIES

THE outcome of the recently convened 14-nation I.C.A.O. conference (it opened in Geneva on September 6) was agreement on three important points: the governments' "joint support" for (1) the financing, manning and operation of air traffic services, meteorological services, telecommunications and navaids in Iceland, Greenland and the Faroes; (2) financial arrangements based on agreements between the interested states, rather than between I.C.A.O. and the Danish and Icelandic Governments (I.C.A.O.'s rôle would be administrative); (3) the contracting governments to share 95 per cent of the costs, with Denmark and Iceland paying five per cent. Proportions for each contracting government would be determined each year according to the usage of the facilities by each country's aircraft.

CATHAY PACIFIC DECADE

LAST week the small privately owned British airline in the Far East, Cathay Pacific Airways, whose base is in Hong Kong, looked back on its first ten years of operations.

Formed on September 24, 1946, by two former pilots of the China National Aviation Corporation, Roy Farrell and Sidney de Kantzow, Cathay Pacific started life with two DC-3s. In 1948 the airline underwent reorganization, when Butterfield and Swire (and associated shipping interests), together with Australian National Airways, acquired a majority holding.

Today the fleet comprises one DC-6, one DC-4 and one DC-3, with a DC-6B on order for delivery "in the near future." Routes are operated to Bangkok, Calcutta, Labuan, Manila, Rangoon, Saigon and Singapore. The DC-3 undertakes a good deal of charter flying, including the transport of labourers from Hong Kong to New Guinea for the British Phosphate Commission in the Gilbert and Ellis Islands; the movement of U.S. military personnel from Manila to Hong Kong on leave; and the carriage of ship crews between points ranging from Sydney to Calcutta. At present the airline is carrying out an airlift between Korea and Hong Kong for British personnel stationed in Korea.

Cathay Pacific (whose initials C.P.A. are often confused with those of Canadian Pacific Air Lines) is proud of its all-British constitution, pilots, crews and maintenance engineers. Some measure of future prospects is provided by last year's increase in passenger traffic—80 per cent compared with the previous year.

Cathay Pacific's hard-working Douglas trio—DC-6, DC-4 and DC-3—seen together for a brief moment on their own ground at Kai Tak Airport, Hong Kong. As recorded on this page, Cathay Pacific have just celebrated their tenth birthday.

James Pyle (right), acting administrator of the C.A.A., seen at the controls of the Boeing 707 on September 24. He was flying the aircraft to assess its air traffic control behaviour.

AIR FREIGHT REVENUES

NEXT Monday, members of I.A.T.A. will resume their workaday committee sessions at a meeting in Paris to discuss general cargo air rates, which expire on December 31 and have been the subject of discontent among a group of airlines including some European carriers. These airlines contend that the wording of some descriptions of specific commodities are so vague and all-inclusive that the goods travel at lower revenue rates than they should. They say also that the higher costs which they have to meet can only be met by raising cargo rates and they propose that this should be done by increasing the basic rates for specific goods.

An opposing point of view is held by another airline group—headed by PanAm—who consider that it would be simpler to increase the revenue by moving goods into higher rate classifications and leave the basic rates as they stand. Whatever the outcome may be—the U.S. Journal of Commerce anticipates a five per cent increase in rates on January 1—this problem falls within I.A.T.A.'s particular province for achieving a solution that will satisfy both arguments.

DISCORD I—

THE president of the Air Transport Association of America, Mr. Stuart G. Tipton, has just issued a statement on the subject of the hard words still being exchanged between the Dutch and the Americans about K.L.M. traffic rights in the U.S.A. (see *Flight* for July 27). The United States Government has, he says, been taking care of Dutch interests since 1946, enabling K.L.M. to "build a world-wide network on American traffic, although the Netherlands' own traffic could not support the extensive Dutch operations." Quoting figures to illustrate this point, he shows that American airlines in 1955 took the equivalent of £39,000 out of Amsterdam while the Dutch airline took £4,600,000 out of New York. Similarly the comparative number of passengers was 432 and 41,895.

"The Dutch airline," states Mr. Tipton, "receives full equality with American-flag airlines in the American market from New York and Miami, two of the world's greatest air transport gateways. After all this, it is astonishing to hear our government's policy referred to as restrictive, or to receive threats of retaliation abroad against American-flag airlines."

—DISCORD II

A REPORT from Rome states that "Italian aviation circles" have appealed to the government for protection against Lufthansa competition on routes to the Middle and Far East.

The difficulty seems to have arisen not so much over Lufthansa's rights to use Rome and other Italian airports for services to and from Germany, but over the question of fifth freedom rights when Lufthansa extend their services from Italy to the Middle and Far East.

As recorded in "Flight" of September 7, the American trading firm of Daniels and Fisher decided to bestow one of their "creativity" awards upon the makers of the Viscount. Mr. Thomas Gammon, deputy managing director of Vickers-Armstrongs Aircraft, went to Denver to receive it, and is seen here shaking hands with Baron Robert Silvercruys (left), Belgian Ambassador in the U.S. The others, from left to right, are Baroness Silvercruys; Mr. Joseph Fisher, president of Daniels and Fisher; and Mr. R. Botterill of Vickers. The exhibition in the background was arranged by Continental Air Lines, who have 15 Viscounts on order.

CIVIL AVIATION . . .

YEADON IN THE DARK

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The operators of the airport, Yeadon Aviation, Ltd., are alive to the necessity of improving the night landing facilities, but, because they are subject to one month's notice, are reluctant to make further improvements (they have spent £30,000 on bringing back Yeadon into operational use) until a decision on the future of the airport has been made. At the moment, Yeadon Aviation rent the airport from the Air Ministry, who in turn pay a rent to Leeds and Bradford Corporations. A decision on the sale of the airport to the Ministry is reported to have been "pending for three years."

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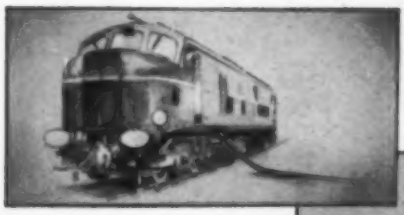

By land or by air Lockheed-Avery pressure replenishing couplings make for speedy, safe refuelling.

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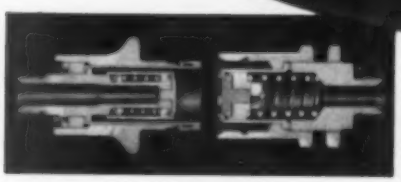
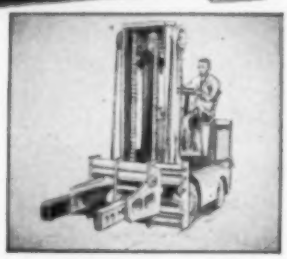
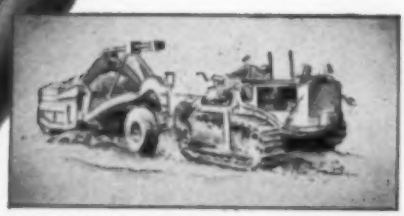


Lockheed-Avery hoses add dependability to your mechanical handling equipment. More work—fewer breakdowns.



Replenishment couplings for the pressure replenishment of oil or fuel tanks enable a very high rate of flow to be used with safety and with considerable saving of the time required for refilling.



Rugged agricultural and earth-moving tackle needs tough hose lines. Lockheed-Avery reinforced hose is made for the job.

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CIVIL AVIATION . . .

Aquila's Solent G-ANAJ was severely damaged at Santa Margherita, Italy, on September 26 when she parted from her moorings in heavy seas and was washed on to the beach.

* * *

Swissair have ordered a third DC-8, for delivery in 1961. This brings the DC-8 score to 111 (compared with the 117 Boeing 707s firmly ordered and 134 "covered by firm contracts or letters of intent").

* * *

Skyways' Crusader service to Cyprus is now being operated by the company's Hermes instead of York aircraft. The first service left Stansted on September 18, and will continue fortnightly *via* Malta for a return fare of £80 (£55 for Service personnel).

* * *

Air-India International has decided to have its own maintenance base at London Airport. Costing some £37,500, it will be Air-India's first overseas engineering base. Target date for completion is June 1957, and the base, complete with 135ft-wide hangar, will be built in the No. 2 maintenance area.

* * *

Aer Lingus are to extend their services to include Switzerland and Germany. Present international services include the Netherlands, Spain and France as well as the U.K. No date was mentioned by Mr. J. F. Dempsey, general manager of Aer Lingus, when he announced this in Edinburgh; the expansion would, he said, be made "as soon as we have enough aircraft."

FORTHCOMING EVENTS

Oct. 4-5. Air Traffic Control Convention, Southend.
Oct. 5. Helicopter Association: "Strain Gauge and Blade Motion Recording Systems for Helicopters," by P. D. MacMahon.
Oct. 6. British Interplanetary Society: "Study of the High Atmosphere in the International Geophysical Year," by Prof. H. S. W. Massey, F.R.S.
Oct. 9. R.Ae.S.: Section Lecture: "The Pressure Jet Helicopter," by A. Stepan, Dipl.-Ing.
Oct. 10. R.Ae.S.: Graduates and Students Section: "Service Flight-testing of High-speed Aircraft," by S/L. P. D. Thorne.
Oct. 11. R.Ae.S.: Main Lecture at Henlow: "Rocket Motors," by S. Allen, F.R.Ae.S.
Oct. 16. Institute of Navigation: A.G.M. and Presidential Address: "The Place of Navigation in Modern Air Transport," by Captain A. M. A. Majendie.
Oct. 17. R.Ae.S.: Main Lecture: "Importance of Time in Aircraft Manufacture," by A.Cdre F. R. Banks, C.B., O.B.E., F.R.Ae.S.
Oct. 23. R.Ae.S.: Section Discussion: "Functional Efficiency of Aircraft," introduced by C. Abell, O.B.E., F.R.Ae.S., and A. V-M. A. F. Hutton, C.B., C.B.E., D.F.C.

R.Ae.S. Branch Fixtures (to October 22):

Oct. 10, *Luton*, "The A.R.A. Transonic Tunnels," by A. B. Haines. Oct. 11, *Henlow*, Main Lecture (see above). Oct. 17, *Coventry*, "Problems Associated with Production and Use of Wrought Aluminium Alloys," by G. Forrest and K. Gunn. Oct. 22, *Glasgow*, "Development of the Jet Propulsion Gas Turbine," by G. C. R. Mathieson.

B.O.A.C.'s first DC-7C is due to be delivered on October 17, and delivery of all ten aircraft should be completed by April. As previously recorded in *Flight*, transatlantic services will start in January. (See photograph on page 594.)

CLUB AND GLIDING NEWS

FOURTEEN women pilots visited Sandown Aerodrome, Isle of Wight, for the flying meeting organized by the British Women Pilots' Association on the weekend of September 22-23. All arrived by air, and were hospitably welcomed by the two resident pilots of the Isle of Wight Air Centre, Miss Mary Wilkins and Miss Betty McCullough. The visiting aircraft comprised six Tiger Moths, two Austers, a Magister and a Monarch—the Monarch having flown the greatest distance, from Staverton, piloted by Miss Winifred Steele. The weekend's activities included refresher trips and competition flying, plus an impromptu Tiger Moth race organized by two male intruders, Norman Jones and C. Nepean Bishop, and an aerobatic display by "Bish".

ANNUAL General Meeting of the Lancashire Aero Club will be held on Wednesday, October 10, at 8 p.m. in the clubhouse, Barton Aerodrome, Eccles.

KADUNA Airport, Northern Nigeria, is the base of a newly formed flying club which has been started by Capt. E. Minshaw, chief pilot of the Northern Region Communications Flight. The fleet will comprise Austers.

FOLLOWING completion of prototype tests, the Czechoslovak LD-40 Meta-Sokol four-seater touring aircraft has been put into production, with deliveries scheduled to begin next year. Powered by a Walter Minor 4-III engine of 105 h.p., the machine incorporates an unusual form of tricycle undercarriage in which the single wheel is located to the rear of the main legs and almost in line with the trailing edge of the wing.

JUST published by the British Gliding Association is a cheap edition (price 5s) of *On Being a Bird* by Philip Wills. The full text remains as in the edition originally produced by Max Parrish in 1953; the photographs have been changed; and the appendices on gliding clubs and records have been brought up to date.

In our original review of the book we wrote of the author; "His gliding adventures in this country, in South Africa (where he joined vultures in their soaring), among the snow-covered peaks of Switzerland, high above the sunbaked Spanish plateau, and inside the very wet cumulo-nimbus clouds of England—all these are described vividly and with great good humour in this book. Glider pilots will have read some of these accounts before, but they are here collected and linked by an appropriate mixture of anecdotes and technical description to appeal not only to gliding folk but to all who love flying. . . ."

Certainly there is no better value for *all* readers of *Flight* than this attractively produced combination of adventure story and imaginative textbook. Impecunious club pilots can now own their own copies with little financial difficulty; while the new edition should bring an insight of gliding—and good gliding writing—to an even wider public.

Copies are obtainable (price 5s 3d including postage) from the B.G.A. at Londonderry House, 19 Park Lane, London, W.1, or from individual gliding clubs.

KENT Gliding Club has now been operating at Detling for six months, and members have logged some 2,000 launches in that time. The "official opening" of the club and bar took place at a party recently. Peter Crabtree has been appointed assistant chief flying instructor.

The Czechoslovak LD-40 Meta-Sokol, referred to in a news item above. Note the unusual configuration of the tricycle undercarriage.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Air Marshal Sir Claude Pelly saying farewell to his staff officers before leaving Cyprus on September 24 to fly back to England in a Canberra. His place as A.O.C.-in-C. M.E.A.F. was taken on the same day by Air Marshal H. L. Patch.

Royal Visits

THE Duke of Gloucester is to visit the R.A.F. Regiment depot at Catterick on October 17. The Duchess of Gloucester, Commandant of the W.R.A.F., will see W.R.A.F. units in Germany between October 15 and 17.

Luftwaffe Officers Return

THREE German officers who have spent some months receiving refresher flying training with the R.A.F., Lt-Col. Wehnelt, Maj. Krupinski and Maj. Barkhorn, have now returned to Germany. They will join Luftwaffe squadrons which are due to be formed next year.

Decorations for Bravery

FOR acting with complete disregard for his own safety during the rescue by helicopter of the crew of a yacht foundering off Hayling Island on June 5, A/C.2 R. E. Martin, a National Service airman serving with No. 22 Sqn., Thorney Island, has been awarded the George Medal.

In gale-force winds a Whirlwind had gone out to rescue the yacht's crew of two —a man and a woman—but its strop had fouled the rigging and the winch had been torn out of the helicopter. A/C.2 Martin came out in a second helicopter and, despite the dangerous conditions, was lowered to the deck of the yacht and supervised the rescue of the man, who was unconscious. He then stayed with the other crew member on the sinking yacht and, clinging to the rigging, prevented her from being washed overboard until the helicopter returned to rescue both of them.

F/L. W. H. J. Parker, R.A.F. Regiment, has been appointed M.B.E. (Military Division) for removing an Eoka terrorist bomb from the entrance of a hangar at R.A.F. Akrotiri, Cyprus, knowing that it was liable to explode at any moment. In fact, it went off less than five minutes after he had dragged it away. F/L. Parker placed a string slip-knot round the bomb, which consisted of dynamite wrapped round a detonator and time-pencil, and dragged it away from the hangar door. It was one of four bombs laid that night, and two of them had already exploded when this one was found.

S.A.A.F. Shackleton 3s

PERSONNEL of the South African Air Force are now undergoing a training course in South Africa preparatory to coming to England to take over the eight Shackleton M.R. 3s which South Africa has ordered from A. V. Roe and Co., Ltd. Early next year the aircrews and technical personnel will come to England to familiarize themselves with the aircraft at the makers' airfield at Woodford before going to Kinloss for a period of operational training culminating in tactical maritime exercises in the North Sea area. In August next year the Shackletons and crews will return to South Africa, where they will be based at D.F. Malan Airfield near Cape Town.

The S.A.A.F. specified many of the new features which differentiate the M.R. 3 from the M.R. 2, especially those which make it suitable for operation in South African conditions. The M.R. 3 is the largest and heaviest aircraft the S.A.A.F. has yet owned and its equipment is reported to be very advanced. In S.A.A.F. service it will have three main operational commitments, maritime patrol, bombing and transport. (R.A.F. Shackletons have, of course, already been used for trooping but not as bombers.)

Other S.A.A.F. equipment includes Sabre 5s and 6s bought from Canada and S-55 helicopters, one of which completed trials at Ysterplaat air station last August.

Night Helicopter Rescue

DURING rescue operations from H.M.S. *Albion* in the Gibraltar area, a Whirlwind made what is thought to be the first night flight from an aircraft carrier by a Fleet Air Arm helicopter. An officer of the Royal Fleet Auxiliary tanker *Echodale* was in serious need of medical assistance, and *Albion* sailed from Gibraltar and made 22 kt towards *Echodale*'s position some 300 miles away. A Skyraider was launched to locate *Echodale* and led the Whirlwind, piloted by Lt-Cdr. B. H. Harris and carrying a doctor, to *Echodale*'s position. This was at 5.20 p.m. The patient was found to be suffering from acute laryngitis and the doctor requested special instruments in case an operation was required. It was then that the Whirlwind made the night flight.

R.A.F. Sports Handbook

THE winter edition of the *R.A.F. Athletic Games Handbook for 1956/7* has now been published and is obtainable from the R.A.F. Sports Board, Air Ministry, Theobalds Road, London W.C.1.

Freedom of Weston-super-Mare

NEXT Friday the freedom of the borough of Weston-super-Mare is to be conferred on R.A.F. Locking and to celebrate the occasion 550 airmen and aircraft apprentices will march through the town with colours flying, drums beating and bayonets fixed. The illuminated scroll recording the granting of the freedom will be presented by the Mayor, Councillor H. J. Holcombe, J.P., to G/C. D. N. K. Blair-Oliphant, the Station Commander. The Mayor will then take the salute at a march-past.

Air Chief Marshal Sir Donald Hardman, Air Member for Supply and Organization, will represent the Air Council and Air Marshal Sir George Beamish, A.O.C.-in-C. Technical Training Command, will also be present. R.A.F. Locking is the home of No. 1 Radio School which, as No. 1 (Training) Wireless School, was formed at South Farnborough, Hants, in 1915.

Reunions

THE reunion of Nos. 50 and 61 Squadrons will be held at the Cock Inn, Fleet Street, London, E.C.4, on October 27 at 6 p.m. Tickets, price 10s, from Jack Lascelles, 15 Crantock Road, Catford, London, S.E.26.

The 39th annual reunion of No. 92 (East India) Sqn. will be held at the Eccleston Hotel, Victoria, London S.W.1, on October 19. The guest of honour will be Air Chief Marshal Sir James M. Robb and the reunion president will be W/C. R. R. Stanford-Tuck. Many other well-known pilots who served with the squadron at Biggin Hill and in the Western Desert will also attend. Details from the Adjutant, No. 92 Sqn., R.A.F. Linton-on-Ouse, Yorks.

A CF-100 all weather fighter receives a NATO camouflage colour scheme in readiness for its flight over the Atlantic to join an R.C.A.F. squadron in France. Aircraft so painted are being returned to squadrons in Canada until the ferry flights begin.

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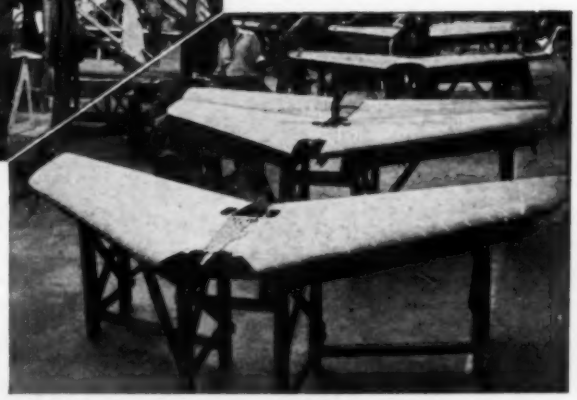

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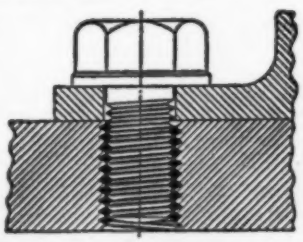

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM DRAGON AIRWAYS, LTD., of Newcastle Airport, Woolsington, Newcastle-upon-Tyne, 3:—

APPLICATION No. 960. For a Normal Scheduled Service with D.H. Heron aircraft and later possibly with Viking aircraft for the carriage of passengers, supplementary freight and mail between London Airport and Cork (Farmers Cross) at an initial frequency of seven services weekly and later increasing to 14 services per week for a period of ten years commencing three months from date of approval.

APPLICATION No. 961. For a Normal Scheduled Service with D.H. Heron aircraft and later possibly with Viking aircraft for the carriage of passengers, supplementary freight and mail between Newcastle (Woolsington) and Dublin (Collinstown) at an initial frequency of seven services weekly and later increasing to 14 services per week for a period of ten years, commencing three months from date of approval.

APPLICATION No. 546/1. From East Anglian Flying Services, Ltd., of Southend Airport, Southend-on-Sea, Essex, for an amendment to the terms of approval of the U.K. Internal Service which they are authorized to operate with D.H. Dove and D.H.89 aircraft during the season June to September each year for the period up to 31st March, 1960, on the route Portsmouth-Guernsey (optional)-Jersey, so as to increase the present frequency of three return flights per week to 15 return flights weekly.

FROM EAGLE AVIATION, LTD., of Marble Arch House, 32-50 Edgware Road, London, W.2:—

APPLICATION No. 965. For a U.K. Internal Service with Dakota and Viking aircraft, and later possibly with Viscount aircraft, for the carriage of passengers, supplementary freight and mail between Manchester (Ringway) and Birmingham (Elmdon) at a frequency according to traffic demand for a period of ten years, commencing from date of approval.

APPLICATION No. 967. For a Seasonal Normal Scheduled Service with Dakota and Viking aircraft and later possibly with Viscount aircraft, for the carriage of passengers, supplementary freight and mail between London (Blackbushe) and Perpignan with an optional traffic stop at Lyon, at a frequency in accordance with traffic demand during the season from April to October inclusive each year, for a period of ten years, commencing from date of approval.

FROM CAMBRIAN AIRWAYS, LTD., of Cardiff Airport, near Barry, Glam. for the following Normal Scheduled Services with Dakota and D.H. Heron aircraft for the carriage of passengers, supplementary freight and mail, for a period of ten years, from date of approval:—

APPLICATION No. 968. for a service between London Airport and/or Bristol and/or Cardiff-Cork at a frequency in accordance with traffic demand.

APPLICATION No. 969. For a service between Haverfordwest and Cork at a frequency in accordance with traffic demand.

APPLICATION No. 970. For a service between Belfast (Nutts Corner) and Dublin (Collinstown) at a frequency in accordance with traffic demand.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [5788

PUBLIC APPOINTMENTS

ASSISTANT Photographers required by Ministry of Supply at Aeroplane and Armament Experimental Establishment, Boscombe Down, Wilts, and Armament Research and Development Establishment, nr. Sevenoaks, Kent, to assist in all types of still and cine photography. Candidates must be at least 16 and under 21 on September 1, 1956, and should normally have G.C.E. (Ordinary) with passes in at least one scientific subject, maths and English.

STARTING salary according to age: £201 (age 16) up to £324 (men) or £320 (women) at age 20. Promotion to Photographer at age 21 if a preliminary I.B.P. or C. and G. Intermediate Certificate in Photography has been obtained. Training facilities available to enable selected candidates to obtain above-mentioned qualifications. Prospects of establishment in not less than two years. A working knowledge of developing, printing and print finishing desirable but not essential. Send postcard, quoting HC/2D/237 to Ministry of Supply, Bst.3.C.1, The Adelphi, John Adam Street, London, W.C.2, for application form. Closing date for receipt of completed form is October 19, 1956. [5772

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APPLICATION forms obtainable from

Senior Representative (AP.65),
Department of Supply,
Australia House,
Strand,
London, W.C.2.

with whom applications should be lodged by 1st November, 1956. [5787

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PATENTS

THE Proprietor of British Patent No. 695225, entitled "Retractable Air Inlet Screen for Aircraft Gas Turbines," offers same for licence or otherwise to ensure practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, 14 E. Jackson Blvd., Chicago 4, Illinois, U.S.A. [5763

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require in their

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Applications, quoting M.E.D. to the **Technical Personnel Manager, Armstrong Siddeley Motors Ltd., Coventry.**

SITUATIONS VACANT

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APPLICATIONS, quoting E.C.S. to Technical Personnel Manager, Armstrong Siddeley Motors Limited, Coventry. [5761

AERO Engineers required for instructional work on engines and gas turbines. State experience and salary. Box No. 4391. [5755

TEST and Laboratory Engineers required for gyro and electro mechanical instruments. Apply stating age, experience and salary required to S. G. Brown, Ltd., Shakespeare Street, Watford, Herts. [0147

AIRCRAFT section leader design draughtsman required. Salary according to age, experience and qualifications up to £900 per annum. Pension scheme/superannuation fund in operation. Write or Phone: BAYNES AIRCRAFT INTERIORS LIMITED, Langley Aerodrome, Bucks. Telephone: Langley 451. [0476

LARGE British Maintenance Company in Far East require engine overhaul engineers with experience of various Pratt & Whitney and/or Dart engines. Qualifications—at least five or six years overhaul and/or constructional experience. Replies to Box No. 4390. [5754

TECHNICAL Author required, preferably with experience in writing aircraft maintenance and repair manuals to S.B.A.C. requirements. Apply with details of age, experience and wage required to Personnel Manager, Scottish Aviation Limited, Prestwick Airport. [5753

WANTED immediately, Senior and Intermediate Draughtsmen for work on an interesting Aircraft programme. Good salaries and conditions. Apply in writing with details of previous experience to: King Aircraft Corporation, Hillington, Glasgow, S.W.2. [0423

AIR SERVICE TRAINING requires Technical Instructor for engine and airframe sections of A.R.B. Pilot examinations. Write giving details of age, experience, qualifications held, to Commandant, Air Service Training, Ltd., Hamble, Southampton. [5743

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APPLICATIONS to: Henstridge Aerodrome, nr. Templecombe, Somerset. [5747

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A TECHNICAL Clerk, experienced in the compilation of Appendices 'A' for aircraft, is required to work in the Osborne, I.O.W., office of Saunders-Roe Limited. Those interested should apply quoting age, experience, salary and ref: P.7 to the Personnel Officer, Saunders-Roe Limited, East Cowes, Isle of Wight. [5770

ASSISTANT required in Publicity Department of aircraft manufacturing company. Essential qualifications: ability to write straightforward English, wide knowledge of aviation, some journalistic and advertising experience, under 35 years of age. Application, in writing only, stating age, education and details of career to: The Publicity Manager, The Fairey Aviation Company Limited, 24, Bruton Street, London, W.1. [5768

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SITUATIONS VACANT

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DOVE Captain required for oil company's air service in the Middle East, preferably with A.L.T.P. licence, but senior commercial or commercial pilots licence holders may apply; a valid I/R is essential. The contract is for a two-year term, renewable at option and each term has a corresponding home leave period of 96 days. Applications in writing detailing licence particulars, experience, age and family status to: Airwork Ltd., Overseas Division, Sutton Lane, Langley, Bucks. [5775

BRITISH OVERSEAS AIRWAYS CORPORATION have vacancies for Link Trainer Instructors in the Central Training Unit at London Airport. Essential qualifications: Ability to express themselves clearly and interestingly; at least two years instructional experience and a sound knowledge of modern radio approach aids, including Radio Range, I.L.S., A.D.F., etc. Experience as a Pilot and/or R.A.F. Link Instructor category or equivalent is desirable. Shift duties are involved and the salary range is £775 to £937 10s. per annum, plus shift pay when applicable. Pension scheme, holiday and sick pay entitlements. Excellent sports and social activities.

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ASSISTANT Aircraft Engineer required by Tanganyika Government Lands and Surveys Department on contract for 30-36 months. Salary scale (including inducement pay) £753 rising to £945 a year. Gratuity at rate of 13½% of total basic salary and inducement pay drawn. Outfit allowance £45. Free passages. Liberal leave on full salary. Candidates must have had training in general aeronautical engineering, with at least three years subsequent experience of airframe and engine maintenance. They must be capable of assisting in the maintenance and overhaul of "Prince" aircraft. Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/41962/FE. [5771

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PILOT, 3,100 hours, 40 types including Meteor and Mosquito, maintenance testing, instructing, air survey, and organizing experience, seeks interesting job, preferably combining flying with sales or managerial work. Box 4455. [5774

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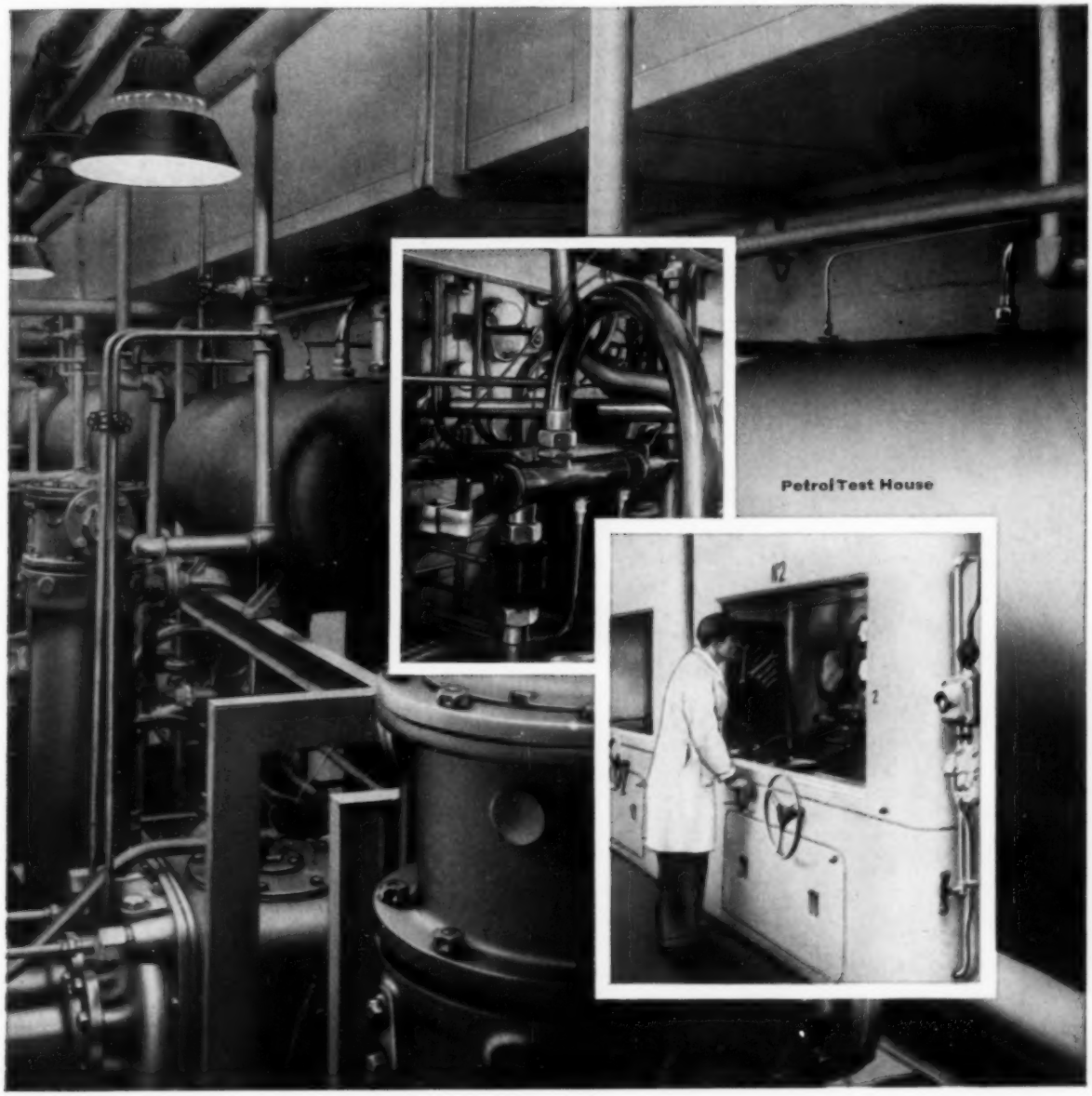

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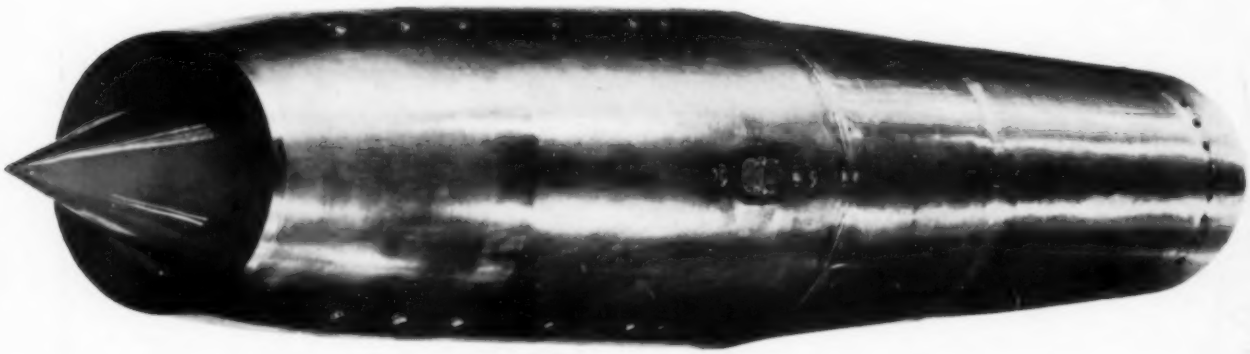

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